LOGIC

HIGHER SECONDARY FIRST YEAR

Vol-I



TAMILNADU TEXTBOOK SOCIETY

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Vol. I

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TAMILNADU TEXTBOOK SOCIETY
MADRAS

First Edition — 1978

(Prepared by the Committee constituted under the authority of the Government of Tamilnadu)

Price : Rs. 2-30

This book has been printed on 60 G.S.M. paper.

Printed at :
Neo Art Press, Madras-600 002

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Further Chapters will be continued in Vol. II

Chapter I

THE NATURE AND SCOPE OF LOGIC

At the outset it is better that we start with a general idea of logic rather than with a strict definition. For a truly precise definition of logic cannot be formulated at the beginning of our study and any definition will be clear only after a considerable study of the subject. Therefore, we shall not attempt any definition of logic but try to understand the nature and scope of it by considering the aspects with which it is concerned. Further logic is not where it was once. Therefore, it would be better to say what logic does than what logic is.

Section 1. What is logic ?

Etymologically the term 'Logic' means a study which is concerned with reason and language. In its traditional sense it is the science of reasoning. Reasoning means passing from something that is given to something that is not given. We look at the sky and find that it is cloudy. We say that it will rain. This is reasoning. The ability to reason depends on the power of seeing connections among facts. Reasoning consists in pondering upon a given set of facts so as to elicit their connections. It is the instrument by which we attain the truth or derive knowledge about anything. Correct methods of reasoning alone lead us to truth. Wrong and confused thinking does not. Logic is the science which inquires into the correct methods of reasoning. It describes

for us the principles and laws along which correct reasoning proceeds. The study of logic, therefore, is of great help in reasoning correctly. Further, logic is mainly concerned with the description and explanation of the various forms of reasoning. In short, *logic is the study of the rules and conditions of reasoning by which men arrive at conclusions.* The logician is primarily concerned with the classification and evaluation of the rational ways in which men seek to establish their assertions. Logic studies reason as a tool of knowledge.

Section 2. The sub-fields of logic

In every form of reasoning from certain ideas or statements or propositions a conclusion is obtained. Such statements are called *premises.* A premise is one that provides evidence for conclusion. Thus a premise is a statement from which another statement, namely a conclusion, is drawn. So reasoning includes: (i) the premises or data or evidence or grounds and (ii) the conclusion or the inference. *The process of passing from the premises to the conclusion is called inference.*

Reasoning or inference is either deductive or inductive. If reasoning takes the form of drawing conclusions from evidences which are taken for granted, it is deductive. On the other hand, if reasoning starts from observed facts and tries to discover their nature it is inductive. Let us illustrate the two types of inferences by taking examples. We say that if a cricket ball is thrown up, it will be gravitated because we take it for granted or assume that all material bodies gravitate. Hence we assume the truth of the statement "all material bodies gravitate", and the conclusion that 'the cricket ball will be gravitated' necessarily follows from the premise. In other words, here the premise implies the conclusion. If the premise implies the conclusion the inference is called deductive. But what is the justification for the statement that "all material bodies gravitate ?" As evidence we point out that the observed particular facts such as a fruit falling to the ground, an aeroplane which has developed engine trouble falling to the ground, a stone thrown up falling to the ground and so on. Here, we are finding justification in the form of particular facts of experience. But the evidence in the form of particular facts is not certainly conclusive because we cannot observe all

material bodies falling to the ground. The conclusion "all material bodies gravitate" is not contained in the information that the material bodies so far observed have been gravitated. If the conclusion is an inference based on particular facts of experience, the reasoning is called inductive. While deduction is necessary reasoning based on premises which are taken for granted, induction is general reasoning based on observation of particular instances. In both the processes we produce reasons or justifications for what is asserted. To find out or to discover that all material bodies gravitate we produce reason or justification in the form of particulars. To prove that the cricket ball will be gravitated we produce justification or reason in the form of a general statement that all material bodies gravitate. In logic, generally, we call these justifications arguments. The justifying (supporting) statements are called premises. The statement justified (supported) by the premises is termed the conclusion. In both the processes, deductive and inductive, we proceed from the premises to the conclusion. *If we proceed from the particulars (premise) to the universal (conclusion) it is inductive; and if we proceed from the universal (premise) to the particular (conclusion) it is deductive.* Thus logic which is the study of inferences or justification of arguments is organised into two fields—deduction and induction. Deduction comprises of the various methods of proof and it means "the process of leading down". Induction comprises the various methods of discovery and it means "the process of leading into".

Inferences are formally and materially valid. An inference is formally valid with reference to the correctness or sequence of the form of the evidences. Inference is materially valid if it is in accord with the relevant facts, if there is agreement with reality. That is, it is true, or materially valid with reference to the content or matter of the facts. *Reasoning is valid or invalid in virtue of its form and it attains to be true or false in virtue of its matter.* Formal validity is linked with the form of inference, while material validity deals with the matter of inference. In deduction we deal with the formal conditions of inference. In induction we deal with the objective and material conditions of inference. Deduction is the logic of conformity to rules or forms. Induction is the logic

of conformity to facts or truth. Deduction is the logic of consistency. Induction is the logic of experience. Deduction is called formal logic because it is mainly concerned with the form or structure of reasoning. Induction is called material logic or scientific methodology because it testifies to the content of reasoning. Induction may also be called scientific inference. All reasoning, when fully stated, has both a formal aspect and a material content. While deduction testifies to the formal aspect of reasoning, induction guarantees to the material content. To quote from A. A. Luce "As a logical process induction leads the mind on from fact to fact like a working bee passing from flower to flower; while deduction like the spider, draws down thread from thread and weaves its web. The two processes meet at the general propo sition". Hence logic has been called the science of the objective and formal conditions of inference. In short, logic is the name for the general study of arguments.

Section 3. Logic is a science

We may describe logic as the scientific study of reasoning. Generally it is called the science of reasoning. What is a science? If ideas are organised and presented in a cogent manner, it is a science. The aim of science is to trace order in nature. A science seeks to ascertain the general laws or conditions of things and events. It is a reasoned system of knowledge. It is characterised by generality and system. In short, *science means organised knowledge.*

A science is confined to the study of a particular subject or aspect of nature, e.g. Physics. A scientist is one who knows more and more about less and less. Science is primarily concerned with the types, kinds or classes of events and objects of a special field of nature.

Science means critical discrimination. It involves reflective thinking which is also relevant thinking. It studies facts carefully and interprets them impartially. It studies facts as they are. This requisite of science to get at the naked facts is usually described as the scientific frame of mind. Science collects facts of actual observation and explains the facts in terms of hypotheses. In other words, every science employs the methods of description (observation or collection of data or facts) and explanation

(suggestion of the general principle underlying the collected facts). Every science is concerned with formulating laws that govern its subject matter.

Scientific knowledge is different from popular knowledge. While scientific knowledge is definite and precise, involving analysis and discrimination of facts, popular knowledge is indefinite, vague, casual and indiscriminate. While scientific knowledge is free from bias and prejudice, popular knowledge is governed and usually guided by the pet ideas, prejudiced views and partial truths. While scientific knowledge is organised knowledge, popular knowledge is usually a medley or jumble of isolated facts. While scientific knowledge is deep and exhaustive, popular knowledge is superficial and contingent. While scientific knowledge expresses itself in universal and necessary principles, popular knowledge is characterised by limited and contingent sentences. In short, while scientific knowledge is reflective and critical, popular knowledge is unreflective and uncritical.

Now turning to our subject we find that logic possesses all the characteristics of a science. It confines itself to the study of reasoning. Logical reasoning requires that we make statements in order. Logic gives us exact and systematised knowledge of the forms of reasoning. It helps us to understand the way in which reasoning goes on. It enumerates, classifies and describes the various processes of reasoning which are employed in gaining knowledge. It explains how the various forms of reasoning are connected with and related to one another. It formulates laws which govern valid reasoning. *Logic is concerned with consistency.* It, scientifically, investigates the methods of observation and experiment, induction and deduction, analysis and synthesis, hypothesis, theory, law and fact, proof, demonstration and probability, cause and effect, axioms and postulates, description and explanation, definition and classification and many other forms and methods of reasoning. In short, logic is a science which investigates, discovers, expresses, systematizes and explains the rules of valid reasoning.

Section 4. Logic is a formal science

Logic deals with reasoning in all the forms. The word "form" means shape, arrangement, orderliness, type, design, pattern,

structure. Two things which are made of the same matter (stuff) may have two different forms (e.g. a jar and a pot). They are materially the same but different in form or shape. Or two things may have the same form or pattern but differ in their materials (content) of which they are made. They are the same in design but differ materially. Thus matter and form are distinct. We can give various examples to distinguish form from matter. Let us take an example from language. Language has a form and matter. The matter of language is called vocabulary. The form of the language consists in the structure of it which is called syntax. To take another example, we know the difference between a tune or a raga and a song or a keerthan. The content or the matter of one song can be different from that of another. For instance, the song may be in praise of a deity or some men and it may be in any language. But whatever may be the content of a song, it must be expressed in a tune or raga. Tune is the form of the song and a song is the content of a tune. In the same way our reasoning has form and matter. The form is the way (pattern, structure) in which we reason. The matter is the various particular objects about which we reason. Logic studies the forms of reasoning as they appear in various instances.

It is true that the forms of reasoning are involved not only in logic but also in every other sciences like physics, chemistry, etc. But we must understand that unlike in other sciences, *the forms of reasoning occupy a special place in logic.* In logic reasoning is the object of study, whereas in other sciences it is merely employed as a tool or instrument. The special sciences do not study reasoning as a process. Every science employs various methods or forms of reasoning in order to make discoveries and establish them. The scientist is not primarily interested in these methods or forms of reasoning. His main interest is in his own special subject matter. The botanist, for instance, is mainly interested in plant life and not in the methods of reasoning, such as description, division and classification which he employs to study the plant life. The logician, on the other hand, pays primary attention to the forms or methods of reasoning employed by the various sciences. He is not mainly interested in the subject matter of the special sciences. The logician abstracts the various methods or forms of reasoning applied in the sciences and makes a special

study of these forms. That is, the logician has to study that which, in science and common life, we do not study but use—the reasoning itself. *Since logic is concerned more with the form of reasoning it is called a "formal science" or a "science of methodology".* The special sciences like physics, chemistry, botany and so on are regarded as material sciences. In short, the ideal of logic is to exhibit 'form'.

Section 5. Logic is the science of sciences

All science is an expression of reasoning. Reasoning is the fundamental tool of the sciences. The origin and growth of the sciences like physics, chemistry, etc. are due to the application of the valid or exact methods of reasoning to various facts. Valid reasoning is governed by certain laws and principles. The business of logic is to investigate into the laws and principles of valid reasoning. *Logic is the analysis of the tools of reasoning.* Since logic investigates into the very instrument, namely, valid reasoning, without which there can be no development of the sciences it occupies a supreme position among the sciences. Hence logic has been called the "science of sciences". And the ancients considered logic as preparatory to all sciences and for this reason they called it "organon or instrument of science".

Before we proceed further let us note, in a clear cut way, what is meant by the following in logic:

1. Argument form and propositional form.
2. Formal and material validity.
3. Truth and validity and deductive arguments.

Section 6. Argument form and propositional form

The broad structure of any argument is divided into premises and conclusion. Let us take the following argument:

All x is y
All z is x

∴ All z is y

This example exhibits the form of an argument but not its contents, i.e. its structure but not what it is about. The structure of the argument is what is called argument form or argument type. The propositions 'All x is y' or 'All z is x' or 'All z is y', each one has also a structure. This structure of the statement (proposition) is called the *propositional form or statement form or formula.* Consider the following arguments :

1. All animals are mortals.
   All monkeys are animals.
   ∴ All monkeys are mortals.

2. All citizens are men who have equal rights.
   All Harijans are citizens.
   ∴ All Harijans are men who have equal rights.

Each of these arguments is about different things. The first argument is about 'monkeys', 'animals' and 'mortals'. The second is about 'Harijans', 'citizens' and 'men who have equal rights'. Though these two arguments have different contents, they have the very same logical form. The form of each of the arguments is this :

All xs are ys
All zs are xs
∴ All zs are ys

This logical form or structure which is common to both the above arguments is called *argument form* or *argument schemata.*

In the same way the statements (propositions)

All **monkeys** are **animals.**
zs xs

and

All **Harijans** are **citizens.**
zs xs

have the same form or propositional structure. This form of the proposition is called *propositional form* or *propositional schema* (The plural of schema is schemata)

Thus when we say that an argument is valid we are saying something about its logical structure and not saying anything about its contents. The logic which deals with the structure of arguments in abstraction from the content or meaning is called *formal logic.*

Section 7. Formal and material validity

All men are mortal beings.
All kings are men.
∴ All kings are mortal beings.

The above argument is valid both formally and materially.

Let us take another argument.

All donkeys are monkeys.
All elephants are donkeys.
∴ All elephants are monkeys.

The form of the second argument is the same as the first. If we examine the arguments we note that the first argument contains a true conclusion whereas the second argument contains a false conclusion. What is it that is exactly false in the second argument? The falsity cannot be due to the form of the argument because it is the same in both cases. Then it means that only the matter or content of the second argument is false and not its form. This is the way in which we show the distinction between formal validity and material validity. The first argument is both formally and materially valid. The second argument is formally valid but materially invalid. That is, it has formal validity alone.

Similarly we can have arguments which have material validity alone (i.e. they have no formal validity). Example :

All graduates are diploma holders.
∴ Some graduates are diploma holders.

Thus we can have the following :

(i) arguments which have both formal and material validity (only such arguments are called sound arguments in logic).

(ii) arguments which have formal validity alone (but no material validity).

(iii) arguments which have material validity alone (but no formal validity).

Section 8. Truth and validity

The above discussion naturally leads us to the conclusion that validity or invalidity pertains to the form of the argument and truth or falsity pertains to the statements (constituents or propositions) of the argument. That is, *only propositions can be true or false, not arguments. Similarly arguments only can be valid or invalid, not propositions.*

The reason for the above view is as follows :

Arguments can be valid in three cases and only in one case they are false.

	Premises	Conclusion	Argument is
Case 1	True	True	valid
Case 2	False	True	valid
Case 3	False	False	valid
Case 4	True	False	Invalid

Consider the following cases :

Case 1.
All boys are males T
All students of this college are boys T
∴ All students of this college are males T

Case 2.
No boys are males F
All girls are boys F
∴ No girls are males T

Case 3.
All donkeys are horses F
All dogs are donkeys F
∴ All dogs are horses F

Case 4.	All men are mortal	T
	All ministers are men	T
∴	All ministers are not mortal	F

Cases 1, 2 and 3 are valid arguments irrespective of the truth or falsity of their premises (Hence we connot say that they are true or false arguments). That is, the forms of these arguments are valid irrespective of the truth or falsity of their premises and conclusion.

The forms of case 1, case 2 and case 3 of the following are the same though the truth value of their propositions varies.

		Case 1	Case 2	Case 3
	All xs are ys	T	F	F
	All zs are xs	T	F	F
∴	All zs are ys	T	T	F

But in case 4, the form of the argument is invalid. It is as follows :

	All xs are ys	T
	All zs are xs	T
∴	All zs are not ys	F

In the first three cases the conclusions follow from their respective premises whether the propositions which constitute the arguments are true or false. In the fourth case *the conclusion does not follow from the premises* though the premises are true. Thus the validity or invalidity of an argument is determined independently of the truth or falsity of the permises of the argument. This means that a valid argument can have false premises and an invalid argument can have true premises. (When an argument is both valid and has true premises it is said to be a *sound argument*).

To conclude, to say that an argument is valid is to say that the premises provide good grounds for getting the conclusion. An argument is said to be valid if it is impossible for its premises to be true and its conclusion false. Any argument in which it is

possible to have true premise or premises and a false conclusion is said to be invalid. Any argument which contains the above characteristic features is called a deductive argument, That is *a deductive argument includes the claim that the conclusion follows from the premises in the sense that it is impossible for the conclusion to be false if the premises are all true.* We may say then that the problem of formal logic is the problem of the distinction between valid and invalid arguments. Logic is the science which evaluates arguments. Logic is another name for the justification offered for drawing a conclusion from premises. In short, logic is the name for the general study of arguments. It is the study of the relation between the conclusion of an argument and its premises. It enables us to distinguish valid from invalid arguments. It does not merely *describe* arguments, but seeks to *evaluate* them. It is a search for rules, norms or criteria which help us to appraise arguments.

Section 9. The value of logic

Logic informs us of the common errors so that we may be on our guard. We can also detect the errors in the arguments of others and point out precisely where the arguments are wrong. It will make for exact reasoning and accurate expression. Thus the utility of logic is rather restricted. Further a person's ability to reason logically provides no guarantee that he will reason logically.

To conclude, we may quote Cohen and Nagel: "Logic cannot guarantee useful or even true propositions dealing with matters of fact, any more than the cutler will issue a guarantee with the surgeon's knife he manufactures that operations performed with it will be successful. However in offering tribute to the great surgeon we must not fail to give proper due to the quality of the knife he wields. So a logical method which refines and perfects intellectual tools can never be a substitute for the great masters who wield them; none the less it is true that perfect tools are a part of the necessary conditions for mastery". In short, logic helps us to distinguish good arguments from bad ones. *It is an essential tool in all the sciences and professions.*

Exercises

1. In the following reasonings, state and explain

   (i) Which are inductive and which are deductive and

   (ii) which statements are premises and which are conclusions.

   (a) The removal of the thyroid gland dulls the intelligence, for this happened in the case of Ramanan, Krishnan, Lakshmi Bai, John, Abdullah, etc.

   (b) The train is coming for the signal is down.

   (c) Socrates must have been a happy man, for all wise men are happy.

   (d) Socrates is a man. Socrates is mortal. Therefore all men are mortal.

   (e) Ram has trouble with logic because freshmen generally have trouble with logic.

   (f) All communists are atheists. Russell is an atheist. Therefore, Russell is a communist.

2. Which of the following deductive arguments are valid and which are invalid. Give reasons. State which statements are true and which false. (Use common sense for deciding the truth or falsity of statements).

   (i) All station wagons are cars. Some Fiats are station wagons. Therefore some Fiats are cars.

   (ii) All men are rich. Kuchelar is a man. Therefore Kuchelar is rich.

   (iii) No boys are girls. Sita is not a boy. Therefore Sita is not a girl.

   (iv) All mangoes are fruits. Malgova is not a mango. Therefore Malgova is not a fruit.

   (v) Some square objects are round. This table is square. Therefore this table is round.

3. Which of the following statements about deductive argument are true?

   (i) An argument may be valid and yet have a true conclusion.

   (ii) An argument may be valid and yet have a false conclusion.

   (iii) An argument may have a true conclusion and yet be invalid.

   (iv) An argument may have a true conclusion and be valid.

   (v) A valid argument may have false premises and a true conclusion.

   (vi) An invalid argument may have false premises and a false conclusion.

   (vii) A valid argument may have true premises and a false conclusion.

   (viii) An invalid argument may have true premises and a false conclusion.

4. Give an example for each of the following:

   (i) True statement (according to common sense).

   (ii) False statement

   (iii) Valid argument.

   (iv) Invalid argument.

   (v) Deductive argument.

   (vi) Inductive argument.

   (vii) Sound argument.

Questions

1. What is logic?

2. What is a science? What is meant by calling logic the 'science of sciences"?

3. What is the subject matter of logic? Indicate its value.

4. Examine the view that logic is a formal science.

5. "Logic deals with the form and not with the matter of argument". Explain.

6. Distinguish validity from invalidity.

7. Distinguish validity from truth.

8. Distinguish between deductive and inductive inferences. Give examples of each.

9. Distinguish argument form from proposition form.

10, What is a deductive argument?

11. Distinguish between formal and material validity.

12. Show how formal logic is a logic of validity.

Chapter II

TRADITIONAL CLASSIFICATION OF PROPOSITIONS

Section 1. What is a proposition?

Logic deals with thought. The nature of thought is always to complete itself. A complete act of thought is one in which something is thought of something else. A complete act of thought is called a judgement. When a complete act of thought is expressed in language, either through words or through symbols it is called a proposition. Examples, "Rose is red", "X is Y". In other words *the expressed content of any thought is a proposition.* Since logic deals with thought as it is expressed in language, the *unit of logical thinking is the proposition.*

Logical thinking is always reasoning of some kind, involving premises and conclusions. The premises and conclusions, which are parts of reasoning, are stated in propositions. Accordingly propositions are parts of reasoning. That is, a proposition is always a premise or conclusion of a piece of reasoning. In short, a *proposition is a constituent element of thinking or reasoning.*

Section 2. Proposition and sentence

We may clearly know what a proposition is by comparing it with a sentence. As an expression of an act of thought the proposition corresponds to the sentence. But it is not the same thing as the sentence which states it. The reasons are :—

(a) The function of a sentence is to express a wish, feeling, desire or information. But the sole function of a proposition is to

communicate information. It is a declarative sentence. It is an assertion. Interrogative, optative, imperative and exclamatory sentences are not propositions. "What O' clock is it?", "May God bless you", "Come down", "How lovely are these pictures!" are not propositions, because they make no assertions. Whatley described a proposition as an 'indicative sentence', that is, a sentence which conveys an information whether the information is true or false. A proposition is a descriptive statement. A descriptive statement (sentence) either conforms or does not conform to things in the outside world. If it conforms, it is true; otherwise, it is false. Sentences which express what is either true or false are propositions. A request, a command, a prayer are sentences, but not propositions. Propositions represent truth values, whereas sentences may not. In short, all propositions are sentences but all sentences are not propositions. That is, the notion of an assertion is the notion of a proposition.

(b) Sentences which are different may assert one and the same proposition. "It is quarter to three", "It is fifteen minutes before three", "It is 2.45 of the clock", are different sentences, but they assert one and the same proposition. That is, all the sentences convey the same information. Similarly the same logical proposition may be expressed quite differently in various languages according to the differences of idiom. "Can the leopard change its spots"? "Can the Ethiopian change his colour"?, in the English language express the same proposition or information as their Tamil equivalent "Can any one straighten the dog's tail"? Similarly, " a cat may look at a king" expresses the same idea asserted in the Tamil proverb that " an opportune time will occur for the cat as it has occured for the elephant". That is why it is said that propositions are not in any specific language whereas the sentences associated with them are in specific languages, English, Tamil, etc.

(c) Propositions may be expressed in words or symbols. But only a verbal expression of a proposition is a sentence. Example: "The elephant is black". Propositions that are expressed in symbols may not be sentences, for the symbols are not words. Examples: S a P, S e P, S $\supset$ P, A v B.

(d) A sentence may be ambiguous, but the very nature of a proposition is that it must be free from ambiguity. That is why

sometimes we have to reduce sentences to the propositional forms to remove the possibility of ambiguity. "The wolf the shepherd killed", is a sentence. But it is ambiguous. So it is not a proposition. This sentence becomes a proposition when it is stated in either way as "the wolf killed the shepherd" or " the shepherd killed the wolf". In either case the ambiguity of the sentence is removed when stated in the propositional form. This shows that sentences may be used in non-propositional ways.

(e) A sentence may contain more than one proposition or statement. The sentence "The cow and the goat chew the cud" contains more than one statement. This sentence should be reduced in two propositional forms as "the cow chews the cud" and "the goat chews the cud". Thus a proposition is a single statement and it makes one assertion, whereas a sentence may contain more than one statement or assertion.

(f) The grammatical subject and predicate of a sentence are different from the logical subject and predicate of a proposition.

(g) In sentences, we make use of words, but in logic we are interested not in words as words, but in words as terms.

(h) In logic the premise or conclusion of an argument is not a sentence but a proposition.

Section 3. Classification of propositions

Aristotle defines a proposition as a statement in which something is said of something else either affirmatively or negatively. Examples."Monkeys are animals","Birds are not mammals". In the first example, we make a statement about 'monkeys'. In the second, we make a statement about 'birds'. That about which we make a statement is called the *subject* (usually represented by the letter S). In both these propositions we say something about the subject. What is said about the subject is called the *predicate* (usually represented by the letter P). Quite simply, the subject is what we are talking about and the predicate is what we say about the subject. In the first example, we say that 'animals' belongs to the subject, 'monkeys'. In the second example we say that 'mammals' does not belong to the subject, 'birds'. The first proposition expresses (asserts) an agreement between the subject and the predicate, while the second asserts (expresses) a disagreement between the subject and the predicate. Thus a proposition is a statement in which the predicate is asserted of a subject either affirmatively or negatively.

The subject and the predicate, which are constituents of a proposition are traditionally called the *terms* of a proposition. For the traditional logicians every proposition is of the S-P form.

The predicate of a proposition may be related to the subject either unconditionally or conditionally. So, the traditional logicians classified *propositions* on the basis of relation, into either *categorical* or *conditional.*

Propositions of the form 'S is P', 'S is not P' are categorical. A categorical proposition is an unconditional statement. It asserts without any condition. It is a mere statement of fact. Examples: 'Gold is yellow', 'Fire is hot', 'Rose is red', 'This man is tall', 'Rama married Sita'.

Propositions which predicate P of S under a condition are called conditional propositions.

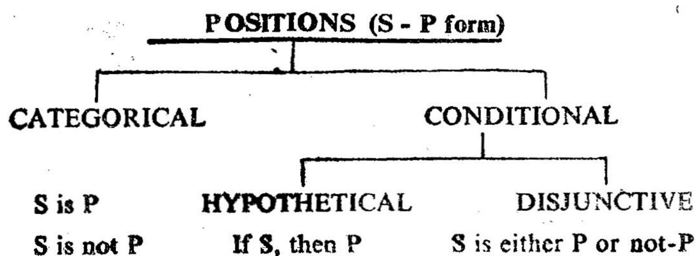
Conditional propositions are of two kinds. They are *(a) Hypothetical and (b) Disjunctive.*

A hypothetical proposition is a conditional statement in which the condition is stated in the "if S then P" form. The condition is in the form of 'cause and effect' relation.

Examples : If there is smoke, there is fire.
If a man takes poison, he will die.
If the weather is fine, the match will be played.

In a disjunctive proposition, which is another conditional statement, the condition is in the form of alternative predications, i.e. S is either P or not-P.

Examples :
The signal light is either red or green.
A given number is either odd or even.
Propositions are either categorical or conditional.
Christians are either catholics or protestants.



Thus according to traditional logic all propositions are of the S - P form and this S - P form may be either unconditional or conditional. This threefold classification is also called classification according to relation.

Note: Traditional logic (Aristotelian logic) has limited the constituents of a proposition to two—the subject and the predicate. (A constituent is an element into which a proposition can be analysed). Thus in the proposition 'rose is red' the constituents are 'rose' (subject) and 'red' (predicate). The S and P in the above example are combined by 'is'. The combining element in a proposition is called the *component*. Here 'is' is the component. Thus, according to traditional logic, every proposition asserts a predication, that is, attributes a predicate to a subject.

Section 4. The Categorical proposition

A categorical proposition is an unconditional statement. It is a proposition where a predicate is *simply* affirmed or denied of a subject. 'Simply' here means unconditionally. It is a proposition without any reservation, without implying any necessary connection between the terms.

Examples :

Man is a biped
Crows are not white.

A categorical proposition can be analysed into three parts—the *subject* term, the *predicate* term and the *copula.* That of which something is said (asserted) is the subject term and what is said (asserted) of the subject term is the predicate term. The subject is that about which something is affirmed or denied. It refers to what the proposition is talking about. The predicate is whatever is affirmed or denied of the subject.

The connecting link between the subject and the predicate is the copula. The copula is the sign of affirmation or denial. The copula is the hinge of the proposition. In the proposition 'the rose is red', 'rose' is the subject term, 'red' is the predicate term and 'is' constitutes the copula. In the proposition, 'crows are not white', 'crows' is the subject term, 'white' is the predicate term and 'are not' is the copula. The copula must be the verb 'to be' in the present tense—is, is not, am, am not, are, are not. Thus a categorical proposition is one in which a predicate is affirmed or

denied of a subject unconditionally. A categorical proposition is a statement that simply asserts that a predicate does or does not belong to a given subject.

Categorical propositions are classified on the basis of their quality and their quantity. *Quality* is either affirmative or negative. *Quantity* is either universal or particular. The affirmative or negative property of a proposition is known as its quality, while the universal or particular scope of a proposition is known as its quantity.

An *affirmative proposition* is one in which the predicate is affirmed of the subject. Example: 'The rose is red'. Here the predicate (red) belongs to the subject (rose). In the affirmative proposition the copula unites, joins or copulates the predicate with the subject.

A *negative proposition* is one in which the predicate is denied of the subject. Examples: 'crows are not white'. Here the predicate (white) does not belong to the subject (crows). In the negative proposition the copula separates or divides the predicate from the subject. Thus the difference between affirmation and negation among propositions is called in logic the difference in quality. While affirmation asserts the *inclusion* of one class *in* another, negation, asserts the *exclusion* of one class *from* another. Thus affirmation and negation are both forms of assertion.

A *universal proposition* is one in which the predicate is either affirmed or denied of the *whole* subject. Examples: All crows are black. No ink is white. Here in each case, the predicate has a *reference* to the *entire* class indicated by the subject.

A *particular proposition* is one in which the predicate is either affirmed or denied of *a part* of the subject. Examples: Some men are teachers. Some ministers are not graduates Here, in each case, the predicate has *a reference only to a part of the class* indicated by the subject. Thus the difference between universality and particularity among propositions is called a difference in quantity. While propositions which predicate something of *all* (or each and every member) of a class are universal, propositions which predicate something of *an indefinite part* of a class are particular.

Combining quality and quantity we get four kinds of categorical propositions. They are :—

THE FOURFOLD SCHEME OF CATEGORICAL PROPOSITIONS

	(i)	(ii)	Sign of quantity	(iii) Subject	Copula	Predicate	(iv)	(v)
1.	Universal in Quantity & Affirmative in Quality	A	All	ants	are	insects	All S is P	S a P
2.	Universal in Quantity & Negative in Quality	E	No	eggs	are	squares	No S is P	S e P
3.	Particular in Quantity & Affirmative in Quality	I	Some	teachers	are	graduates	Some S is P	S i P
4.	Particular in Quantity & Negative in Quality	O	Some	women	are not	teachers	Some S is not P	S o P

Note: Column (i) gives the different combinations of quality and quantity.

Column (ii) gives the different letters customarily used to denote these forms from the first two vowels of *affirmo* (I affirm) and the two vowels of *nego* (I deny).

Column (iii) gives the concrete examples.

Column (iv) gives the symbolic forms of the propositions.

Column (v) gives the symbolic representations of the propositions indicating the quality and quantity by putting the appropriate vowel (a,e,i,o,) between S and P.

Section 5. Reduction of sentences to logical form

A sentence is said to be in the logical form if the four parts of the proposition are clearly stated. The four parts of the categorical proposition are :

(i) Sign of quantity : All, No, Some

(ii) Subject term

(iii) Copula : is, is not, am, am not, are, are not.

(iv) Predicate term.

The following instructions will be helpful in finding out the four parts of a categorical proposition.

(1) *To find out the subject and the predicate terms* ask yourself the following questions:

(a) Of whom or about whom, or of what or about what is the statement made ?
The answer to this question will give the subject term.

(b) What is it that is stated of the subject ?
The answer to this question will give the predicate term.

Now we know the subject and the predicate terms. We have to put them in the form.

Subject—Copula—Predicate

Sometimes the subject and the predicate terms are not given in their proper order. Example: 'Blessed are the pure in heart'. Here the subject is 'persons who are pure in heart'. The perdicate is 'blessed'. So the logical order will be: 'Persons who are pure in heart are blessed'.

We have to remember two things about logical terms.

(i) They may be either single-worded or many-worded. Examples: 'Persons who are pure in heart' (many worded); 'blessed' (single worded);

(ii) The logical terms should be in the *noun* or *noun clause*. Example: 'those who are pure in heart' (noun clause); 'blessed people' (noun). (Note: If the predicate is an adjective it is desirable to supply a noun).

2. *To find out the Quality and Quantity,* ask yourself the following questions.

(a) Is the predicate affirmed or denied of the subject?
The answer to this question will give the quality (affirmative or negative).

(b) Does the predicate have a reference to the whole subject or a part of the subject?
The answer to this question will give the quantity (universal or particular).

Now we know the subject term, the predicate term, the quality (copula: is, is not, are, are not, am, am not) and the quantity (all, no, some) of any given sentence. Now the given sentence can be reduced accordingly to A, E, I, or O propositions.

Further points to remember:

(i) Special care must be taken to see that the copula is in the present tense of the verb 'to be.'

(ii) In the case of E propositions (general) the sign of negation goes before the subject term.

Example : Horses are **not** cows.

No | horses | are | cows.

However in the case of singular E propositions the negation goes with the copula.

Example : Rama | is not | a | muslim

(iii) The tense (past, present, future) indicated by the sentence should be a part of the predicate and not of the copula.

(iv) The essential meaning of the given sentence should not be changed when we reduce it to the logical form.

(v) Remember the logical forms in the following way :

A All | **Subject** | are | **Predicate**

E No | **Subject** | are | **Predicate**

I **Some** | **Subject** | are | **Predicate**

O Some | **Subject** | are not | **Predicate.**

The meaning of 'some' in logic.

In ordinary English we commonly use the word 'some' to mean 'some only'. Thus if we say 'some teachers are good men', it means, in ordinary English, that 'some teachers only are good men', but not 'all'. Whereas in logic we use the word 'some' to mean 'some at least' and not 'some only'. In logic we mean that 'some' teachers *at least* are good men', The word 'some' here does not exclude the possibility of 'all'. i.e. 'All teachers *may be* good men'

(5) To help the students to reduce the given sentence to the logical form the following *practical hints* are given. These hints should not be applied blindly. The student must always try to understand the *meaning* of the given sentence before reducing the sentence to the logical form.

I.	All, Every, Each, Any, He who, Whoever, Whatever, Anyone, Always, Whenever, Invariably	+ Affirmation	=	A
II.	No, None, Never, No one, Nobody, Nothing, Not a single	+ Affirmation	=	E
III.	A few	+ Affirmation	=	I
IV.	Few	+ Affirmation	=	O
V.	A few	+ Not	=	O
VI.	Few	+ Not	=	I
VII.	Some, Most, Many, Almost all, Nearly all, A small number, The majority, The minority, Generally, Certain, Practically all, Several, Often, Mostly, Perhaps, Frequently, Occasionally, Sometimes, Nearly always	+ Affirmation	=	I
VIII.	The above words	+ Not	=	O
IX.	All, Every, Each, Any	+ Do not	=	O
X.	All, Every, Each, Any	+ Cannot	=	E
XI.	Seldom, Hardly, Scarcely Rarely	+ Affirmation	=	O
XII.	The above words	+ Not	=	I

Examples for Hints I to XII:

I. Every sister of mine is an aunt of my children.

L.F. A All | my sisters | are | aunts of my children.

II. No drunkards can keep a secret.

L.F. E No | drunkards | are | those who can keep a secret.

III. A few dreams are wish-fulfilments.

L.F. I Some | dreams | are | wish-fulfilments.

IV. Few untrained people are good observers.

L.F. O. Some | untrained people | are not | good observers.

V. A few paths are not steep.

L.F. O. Some | paths | are not | those that are steep.

VI. Few men are not bald.

L.F. I Some | men | are | those who are bald.

VII. Many Siamese cats have blue eyes.

L.F. I Some | Siamese cats | are | animals which have blue eyes.

VIII. Most general notions are not wrong.

L.F. O Some | general notions | are not | wrong notions.

IX. Not every man is a saint.

L.F. O Some | men | are not | saints.

X. All the doctors in the world cannot save this patient.

L.F. E No | doctors in the world | are | those who can save this patient.

XI. Old habits seldom die out.

L.F. O Some | old habits | are not | those that die out.

XII. Hardly virtuous men are not happy.

L.F. I Some | virtuous men | are | happy men.

XIII. A *singular or individual proposition* is one where the subject is a singular or individual term. It must be taken as universal in quantity. (But this will not have the sign of quantity 'All' or 'No').

Singular term + Affirmation = A.

Example :

Tensing conquered the Everest.

L.F. A Tensing | is | one who conquered the Everest.

Singular term + negation = E.

Example :

We did not attend that marriage.

L.F. E We | are not | persons who attended that marriage.

XIV. *Compound propositions* have two or more subjects or predicates. They are really 'package statements', where more than one proposition is contained or compounded. Such propositions should be split up into simple propositions.

Examples :

1. Jack and Jill went up the hill.
   (Here there are two subjects)

L.F. A Jack | is | one who went up the hill.

A Jill | is | one who went up the hill.

2. Akbar was a great statesman and a warrior.
   (Here there are two predicates)

L.F. A Akbar | is | one who was a great statesman.

A Akbar | is | one who was a great warrior.

Neither Raman or Krishna is intelligent.
(Neither...nor is only a conjunction and should not be confused with disjunction).

L.F. E Rama | is not | an intelligent person.

E Krishna | is not | an intelligent person.

XV. *Indesignate or Indefinite propositions* are statements without any mark of sign of quantity. In such cases the quantity must be determined from the meaning (and the context) of the given sentence. If the predicate refers to the nature of the subject (universally) the proposition can be reduced to universal; otherwise to particular. In cases where we are doubtful about the quantity of the proposition it is safe to consider them as particulars.

Examples :

1. Dogs are not bipeds.

L.F. E No | dogs | are | bipeds.

2. Graduates are teachers.

L.F. I. Some | graduates | are | teachers

XVI. An *exclusive proposition* is one in which the predicate is spoken of as exclusively belonging to the subject. That is, the predicate is limited to the subject and is referable to the subject alone and to nothing else.

In an exclusive proposition the subject of the statement is limited by words like 'only', 'alone', 'none but', 'none except'.

An exclusive proposition may be expressed as an E or A proposition.

To reduce it to an E proposition take the contradictory of the given subject as the new subject. (To take the contradictory of a term add 'non' to it if the term is a noun ; or add 'no' to it if the term is a noun clause; or use the appropriate contradictory. e.g., with × without).

To reduce an exclusive proposition to the A form, interchange the given subject and the given predicate.

Examples :

1. Graduates alone can vote.

L.F. E No | non graduates | are | those who can vote.
S P

L.F. A All | those who can vote | are | graduates
S P

2. Only those with tickets will be admitted.

L.F. E No | persons without tickets | are | those who will be admitted.

L.F. A All | persons who will be admitted | are | persons with tickets.

XVII. An *exceptive proposition* is one in which the predicate is *affirmed* of the subject with some exceptions. The exceptions are indicated by words like 'all but', 'all except'. Such sentences should be reduced to the A form, if the exceptions are definite. If the exceptions are indefinite, reduce the sentence to the I form.

Examples :

1. All but Casabianca fled from the burning deck.

L.F. A All | persons other than Casabianca | are | those who fled from the burning deck.

2. All but one fled from the burning deck.

L.F. I Some | persons | are | those who fled from the burning deck.

XVIII. Interrogative, exclamatory and optative sentences

1. Interrogative sentences

(a) *Rhetorical questions* are interrogative sentences which suggest their own answers. In such cases the answer should be given as the logical form.

Am I not your teacher ?

L F. A I | am | your teacher.

(b) *Context-free questions* are interrogative sentences where we do not know the answers. Such cases should be reduced as follows :—

Example :

1. Is the car a new sports model ?

L.F. A The question | is | one whether the car is a new sports model.

2. *Exclamatory Sentences* should be reduced to logical form as follows :

How beautiful !

L.F. A The thing | is | one which is very beautiful.

3. *Optative Sentences* should be reduced to the logical form as follows :

Examples :

1. Don't proceed further.

L.F. A The warning | is | that one should not proceed further..

2. God bless you.

L.F. A The prayer | is | that God should bless you.

3. Get out.

L.F. A The | order | is | that you should get out.

4. Please get me a cup of water.

L.F. A My request | is | that you should get me a cup of water.

XIX. Sentences referring to abstract *qualities* (nouns) may be reduced as follows :

Examples :

1. Vice never brings happiness.

L.F. E No | vicious persons | are | happy persons.

2. Haste makes waste.

L.F. A All | cases of haste | are | cases that make a waste.

Section 6. Distribution of terms in categorical propositions

A term, we have already seen, is an element of a proposition. *A term,* in logic, *may be viewed in two ways, either as a class of objects or as a set of attributes.* If a term is taken to stand for an object or class of objects it is said to be taken in *denotation or extension.* If a term is taken to stand for an attribute or a set of attributes it is said to be taken in *connotation or intension.* For example, the term "sweet" may stand for the class of sweet things or the attribute of sweetness. There are two terms in every categorical proposition—the subject term and the predicate term—and each may be interpreted in two ways, in denotation, or in connotation. We may take both the terms in denotation. Or we may take the subject in denotation and the

predicate in connotation. We may take the subject in connotation and the predicate in denotation. Or, we may take both the terms in connotation. Usually, in deductive logic, both the terms are taken in denotation. That is, the subject and the predicate terms are viewed as referring to classes of objects.

If we take both the terms to refer to the class of objects, they may refer either to the *whole* class or a *part* of the class for which they stand. When a term refers to the whole class for which it stands, it is said to be distributed. In other words, *if a term is taken in its entirety or whole extent or complete extension or whole denotation, it is distributed.* In a distributed term a reference is made to *all* the individuals denoted by it. A distributed term, in short, refers to each and every member of the class for which it stands. It is distributed to *all* the members of a given class. On the other hand, *if a term is taken only in a limited or partial extent it is said to be undistributed.* In an undistributed term reference is made to an indefinite portion of a given class.

When both the terms in a proposition refer to the class of objects, the subject and the predicate stand in a specific relation. The relation may be either mutual inclusion or mutual exclusion or partial inclusion or partial exclusion. Euler (1707-1783), a Swiss mathematician, represented the distribution of terms and the relation between S and P in categorical propositions by means of circles. With the help of these circles, let us now determine which of the terms are distributed and which are not in the fourfold scheme of categorical propositions.

1. **Universal Affirmative or A proposition.**

e.g. All | ants (S) | are | insects (P)

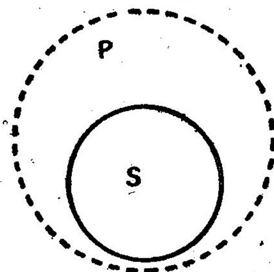


Fig. 1

The proposition really means that *all* ants are *some* insects. The subject term is used in its full extent. Therefore, it is distributed. But the predicate term refers only to such of the 'insects' which are 'ants'. The entire class of 'insects' is not referred to in this proposition. Therefore the predicate term is not distributed. Proposition A affirms in effect, that every S comprises part of the extension of P. The entire extension of S is included in P. Hence *proposition A distributes its subject only.*

2. Universal Negative or E proposition

e.g. No. | men (S) | are | mothers (P)

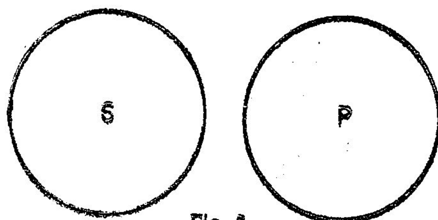


Fig. 2

The whole class of 'men' is excluded from the whole class of 'mothers'. In an E proposition, P is totally excluded from the extension of S. That is, the entire extension of S lies outside P taken in its entirety. Therefore *proposition E distributes both its subject and its predicate.*

3. Particular Affirmative or I proposition

e.g. Some | cats (S) | are | black beings (P)

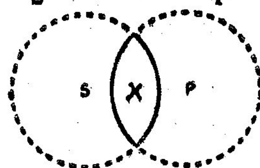


Fig. 3

X refers to (cats that are black) the meaning of the proposition. In this proposition we are not referring to all cats. We are not referring to all black beings.

That is, an I proposition affirms that an indeterminate portion of the extension of S comprises part of the extension P. In this proposition P is affirmed of S only in part of its extension. Therefore both the terms are not distributed. *Proposition I does not distribute any term.*

4. **Particular Negative or O Proposition**

e.g., Some | metals | are not | white things
S P

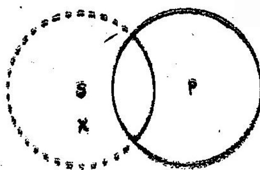


Fig. 4

X refers to the outlying portion of the circle S and stands for the meaning of the proposition (metals that are not white.)

In this proposition we are not referring to all metals. Therefore the subject term is not distributed. The subject is excluded from the whole class denoted (indicated) by the predicate. The predicate term, therefore, is distributed. An O proposition states in effect that P in its full denotation is to be excluded from a portion of S. In an O proposition, P as taken in its complete extension, is denied of an indefinite part of S. *Proposition O distributes its predicate but not its subject.*

Key to circles: A circle drawn in solid (continuous) line indicates a distributed term and a circle drawn in dotted lines (part of whole) represents an undistributed term. A circle drawn inside another indicates inclusion of one class in another. The circles entirely outside each other indicate mutual exclusion. The overlapping circles represent either partial exclusion or partial inclusion.

5 Exception to proposition A

In certain cases, proposition A distributes its predicate also. In such cases the subject and predicate have equal denotation (i.e. S = P).

Example : A All | insects (S) | are | six-legged creatures (P)

S and P

Fig. 5

Here S is taken in its entire extent and therefore distributed. As P is equal to S here, P is also distributed. Thus in some cases of A (where S = P) both the terms are distributed.

We may summarise the results as follows :

a.

Proposition	Subject	Predicate
A	Distributed	Undistributed
E	Distributed	Distributed
I	Undistributed	Undistributed
O	Undistributed	Distributed

b. Universal propositions (A and E) distribute their subject terms, while particular propositions (I and O) do not.

Negative propositions (E and O) distribute their predicate terms, while affirmative propositions (A and I) do not.

c. If the subject is distributed, the proposition is universal in quantity. If the proposition is universal, its subject is distributed.

If the subject is not distributed, the proposition is particular in quantity. If the proposition is particular, its subject is not distributed.

If the predicate is distributed, the proposition is negative in quality. If the proposition is negative, its predicate is distributed.

If the predicate is not distributed, the proposition is affirmative in quality. If the proposition is affirmative, its predicate is not distributed.

The quantity of the proposition determines the distribution of S. The quality of the proposition determines the distribution of P.

d. To indicate the two way rules of distribution the following table will be useful;

Universal	—	Distribute	—	Subject
Particular	—	Undistribute	—	Subject
Negative	—	Distribute	—	Predicate
Affirmative	—	Undistribute	—	Predicate

Significance of distribution in inference :

The concept of distribution is the fundamental idea in the theory of formal (deductive) inference. The general rule of deductive inference concerning the distribution of terms is :—

If a term is not distributed in its premise, it should not be distributed in the conclusion.

We may represent the significance of the rule of distribution in inference as follows :

Terms in Premise :	Whole	Whole	Part	Part
	↓	↓	↓	↓
Terms in conclusions :	Whole	Part	Part	Whole
	V	V	V	W

Key : 'Whole' stands for the distributed term.

'Part' stands for the undistributed term.

↓ stands for the process of inference.

V stands for valid inference.

W stands for wrong (invalid) inference.

Hence the rule of distribution in deductive inference: **"Do not go beyond the evidence".**

Note: In inference we will be using ✓ to stand for distributed term and 'x' to stand for an undistributed term.

Exercises

Reduce the following sentences to strict logical form and indicate their quality and quantity by suitable symbols:

1. With determination all problems can be solved.
2. All men seek happiness.
3. The crew were all foreigners.
4. All graduates can vote.
5. No plant is capable of speech.
6. Every great man gives us a new thought.
7. Some countries are ruled by dictators.
8. Every class has its clowns.
9. Certain people do not exercise their right to vote.
10. Any man can lift this weight.
11. He must work hard who wishes to succeed.
12. Every cloud has a silver lining.
13. Who is afraid of the big bad wolf?
14. Most Americans have no idea of what it means to go hungry.
15. All except women may attend.
16. Not all pastures are green.
17. Whoever breaks the law shall be punished.
18. Only God can make a tree.

19. Cows cannot smile.

20. He is a fool who cannot do this problem.

21. Not all who gain wisdom gain experience.

22. All who are not guilty are innocent.

23. Who will not love him ?

24. Nothing human frightens me.

25. No flatterer should be tolerated.

26. A few scientists are religious minded.

27. Almost all the passengers were injured.

28. If only I could remember what I said.

29. Parents have a responsibility to their children.

30. Certain shop-keepers use false weights.

31. Every subtance except ether can be weighed.

32. Every one except Gita knows how to dance.

33. Several South Indians do not know Hindi.

34. All who are not women may attend.

35. All men have basically equal rights.

36. At least some municipalities are not corrupt.

37. Success often comes to those who dare and act.

38. No minor can make a contract.

39. All but one member of the crew did not survive.

40. It is never too late to mend.

41. Few men are above temptation.

42. A few good writers are good speakers.

43 Barking dogs seldom bite.

44. Few good books on logic are easy to read.

45. Every planet moves in an elliptical orbit.

46. Few men have a sense of humour.

47. Only tresspassers are liable for prosecution.

48. Few men observe strict self control.

49. Dead bees do not sting.

50. The cow is in the meadow.

51. One half of the electorate is not in favour of the elected representative.

52. None but non-smokers need apply.

53. All take great risks who put their eggs into one basket.

54. A few khaddar-wearers are not congressmen.

55. Not all the perfumes of Arabia can sweeten the hands of a murderer.

56. Every sinner has a future.

57. Only experts can judge scientific matters.

58. White cats with blue eyes are generally deaf.

59. All that glitters is not gold.

60. Not all summit conferences in the world can ensure total peace.

61. Will you join this dance ?

62. Thieves ! Thieves !

63. Only criminals hate the law.

64. Not every good bowler is a good batsman.

65. What does he know about cars ?

66. Men are strong and women are fair.

67. Every Ceasar has his Brutus.

68. All men are not drunkards.

69. Thieving never prospers.

70. All the batteries in the flash light are dead.

71. Few men are not free from vanity.
72. Can the leopard change its spots?
73. Every circle is round.
74. Who is not wise after the event?
75. Not all currency notes are genuine.
76. Neither threat nor flattery is going to succeed
77. Only females are mothers.
78. A square circle does not exist.
79. Not any photographer can take a good picture.
80. It is 100 miles to Villupuram.
81. Truth alone will prevail.
82. Every event demands a cause.
83. Many are called but few are chosen.
84. Nearly all voted against the bill.
85. God is.
86. To be wise is to be happy.
87. Generally philosophers are clear thinkers.
88. Firm at his post he stood.
89. That which is born is sure to die.
90. Dead men tell no tales.
91. Adults only.
92. What time is it?
93. A little knowledge is a dangerous thing.
94. The course of true love never did run smooth.
95. Indians believe in rebirth.
96. Every Spartan is a hero.
97. The majority of the M.L.As. are educated.

98 Men are selfish.

99. Every text book is intended for purposes of study.

100. Few insects are poisonous.

101. All the declarations of independence in the world will not render any one really independent.

102. All the riches in the world cannot make the shoe black happy.

103. Can you refuse the request of your dear friend ?

104. Every man is liable to error.

105. Several candidates will obtain scholarship.

106. Do you expect me to be a saint ?

107. Have you placed your order for a new television ?

108. Indians will never tolerate tyranny.

109. It is only the bold who escape.

110. Are not some facts stranger than fiction ?

111. Children rarely realise the difficulties of parents.

112. It is a warm and sunny day.

113. Every disease is not fatal.

114. Nothing is beautiful except truth.

115. To vote is the first duty of the citizen.

116. Water cannot run up hill.

117. Only enterprising people get in.

118. Truth and falsity are incompatible.

119. He is a patriot who loves his country.

120. Villagers lead a simple life.

121. Every mark of weakness is not a disgrace.

122. No crocodiles shed tears.

123. Few important discoveries are due to accident.

124. All is well that ends well.

125. Whoever pays the piper calls the tune.

126. Most words are vague.

127. No true religious man fails to do his duty.

128. Logical examples are tiresome.

129. Only the educated are fit to vote.

130. One of you at least should be able to answer this question.

131. Sometimes all our efforts fail.

132. Any man but a saint would have lost his temper.

133. Only the ignorant believe in magic.

134. Most people lived in a world of dreams.

135. Never will dead speak.

136. A horse is a quadruped.

137. Only civilized people are tolerant.

138. None but the unemployed are lazy.

139. None can refute your argument.

140. Every wrong doer is punished.

141. Forty percent of the population is in dire want.

142. None but foreigners are cheated.

143. Most adults are married.

144. Women are co-operative.

145. Kennedy and Johnson were both Democratic Presidents.

146. None but idiots presist in their folly.

147. No birds have four legs.

148. Certain shop keepers cheat the customers.

149. Never have I seen such ignorance.

150. He who digs a pit for others falls in himself.

151. Only drakes are curly tailed.

152. Salt dissolves in water.

153. Beware of dogs.

154. A few of the heavy metals are not radio active.

155. A clock is for telling time.

156. The natives alone can stand the climate of South Africa.

157. A few socialists are not revolutionaries.

158. None but the young are capable of heroism.

159. Cowards die many times before their death.

160. A few professors are grey haired.

161. What cannot be cured must be endured.

162. Only legal experts can draft an act of parliament.

163. Nothing ever becomes real till it is experienced.

164. What mortal has no cause for regret ?

165. Any student of logic can detect fallacies.

166. Only citizens over twenty one are voters.

167. The audience applauded vigorously.

168. Whatever is not a compound is an element.

169. Each of us is required to study.

170. A few cautious men are wise.

171. Who can deny the value of self control ?

172. All habits except a few can be easily cultivated.

173. Bhima and Arjuna were great warriors.

174. Rolling stones gather no mass.

175. The quickest way is the shortest.

176. The exception proves the rule.

177. The great epic battle was fought at Kurukshetra

178. The planets revolve round the sun.

179. Only citizens are voters.

180. Birds are feathered.

181. None but aristocrats are luxurious.

182. Only metals are good conductors of heat.

183. Every sincere man acknowledges merit in a rival.

184. None but the pure can see God.

185. Few men can keep a secret.

186. Honest men never deceive.

187. The dead alone have peace of mind.

188. Every cloud does not bring rain.

189. Truth is not easy to attain.

190. None but the graduates are allowed to wear the academic gown.

191. Neither Mussolini nor Hitler was an Indian.

192. All the money except yours has been found.

193. A barometer will not work in a vacuum.

194. He is a bad work man who quarrels with his tools.

195. Only indicative sentences make assertions.

196. He jests at others scars who have never felt a wound

197. The extremely fat man is ordinarily a ridiculous person.

198. Our College team won the top award in the State Cricket.

199. Stone walls do not a prison make.

200. Whoever is intelligent is appreciated.

201. None thinks the fools great except the fools themselves.

202. Not all questions have simple answers.

203. Not all need go.

204. Nearly all who were to come have come.

205. Mothers generally love their children.

206. All students except the new comers escaped ragging.

207. Every love except spiritual love is transitory.

208. A bird in hand is worth two in the bush.

209. Only thieves are afraid of policemen.

210. No child is a criminal.

211. Neither you nor I know the answer.

212. At least one student says his prayers.

213. A few Tibetans are devil worshippers.

214. Some tongues wag too freely.

215. Not all mountains are accessible.

216. A few will be unable to go.

217. He is brave who conquers his passions.

218. He envies others wealth who has none himself.

219. Only those who have suffered can be sympathetic.

220. All snakes except water-snakes are poisonous.

221. One swallow does not make a summer.

222. Every democracy respects human rights.

223. Only the communists are radicals.

224. Not all our ideas deserve consideration.

225. Only a few men maintain consistent conduct. (A few + only = some not).

226. All his shots but two hit the mark.

227. Nothing is better than liberty.

228. Every man except Adam was once a child.

229. No one who does not work will get any pay.

230. The weariest river somewhere meets the sea.
231. Every criminal cannot be trusted.
232. Only fools are insulators of humour.
233. Plato and Kant were idealists.
234. Only elephants have trunks.
235. A thing of beauty is a joy for ever.
236. Philosophy and literature are considered as liberal arts.
237. No one who witnessed that scene will ever forget it.
238. Most babies are easily amused.
239. Nearly all the troops have left the town.
240. Few men get all they want.
241. Only the ignorant laugh at philosophers.
242. Nothing succeeds like success.
243. The wearer alone knows where the shoe pinches.
244. Man is neither immortal nor perfect.
245. The earth is the only planet that has an atmosphere.
246. Only weak men take strong measures.
247. Uneasy lies the head that wears the crown.
248. Not all our ideas deserve consideration.
249. He who is content with what he has is truly rich.
250. What fools these mortals be!
251. Only fools rush in where angels fear to tread.
252. Adam and Eve were the only human beings who escaped teething.
253. None but matriculates are students of this college.
254. Merit alone should count.
255. A burnt child dreads the fire.

256. Vedas are sacred scriptures.
257. Wretched are those who work for results.
258. A man may smile and smile and yet be a villain.
259. Two blacks do not make a white.
260. What is not predictable is not desirable.
261. Unasked advice is seldom acceptable.
262. More haste less speed.
263. Fat men are good natured.
264. Nothing done in a hurry is well done.
265. None but citizens can hold property.
266. The Nazis are not the only Aryans.
267. There is no fool like an old fool.
268. More the merrier.
269. Effort is not always rewarded.
270. Money alone will bring you the joys of life.
271. No angels sleep.
272. Politicians alone are against the urban land tax.
273. Whoever diets is always tired.
274. There is no such thing as a pink elephant.
275. Computers will never entirely replace the human brain.
276. A few glasses are trifocals.
277. Few birds are migratory creatures.
278. Only non-voters attended the meeting.
279. Most of the unexpected comments were unfavourable.
280. Your absence was inexcusable.
281. A few unimaginable situations are not uninteresting situations.
282. Every pun is not a joke.

II. Reduce the following sentences to strict logical form and state which of the terms are distributed and which are not distributed in each :

(No. 1 is worked out as model).

1. Every Indian citizen is free.

L.F.A. All | **Indian citizens** (S) | are | **free people.** (P)

Here the subject is distributed and the predicate is not distributed.

2. Sinners are never saints.
3. The cow is a domestic animal.
4. A few dwarfs are intelligent.
5. Few white mice are tiny.
6. Every voter is a citizen.
7. Whom gods love die young.
8. A few men are bald.
9. No man has wings.
10. Lions are carnivorous.
11. Lions are not herbivorous.
12. No true soldier is a coward.
13. Generally scholars are not athletes.
14. No honest man deceives.
15. Most wives work hard.
16. Dogs are not ruminants.
17. Cows are quadrupeds.
18. Few eminent men have distinguished sons.
19. Narrow minded persons never achieve greatness.
20. All are not wise who read much.
21. All leaves are green.
22. No professor is unkind.

23. All infants are irresponsible.

24. Every anarchist is impractical.

25. No cat has nine tails.

Questions

1. Distinguish between a proposition and a sentence.

2. Distinguish between categorical and conditional propositions.

3. Explain the four fold scheme of categorical propositions.

4. Explain the distribution of terms in categorical propositions.

5. Distinguish between:

   (a) Singular and particular propositions.

   (b) Exclusive and exceptive propositions.

   (c) Conditional and unconditional propositions.

6. Distinguish between affirmative and negative propositions and explain the rules of distribution relating to them with concrete examples.

7. Explain each of the following with an example:

   (a) Indesignate propositions.

   (b) Exclusive propositions.

   (c) Singular propositions.

   (d) Exceptive propositions.

   (e) Compound propositions.

8. What is meant by the logical form of a proposition? Why should we reduce sentences to logical form?

9. Explain fully what is meant by the quality and quantity of proposition.

10 What is a distributed term? Explain the signifiicance of distribution in formal inference.

Chapter III

IMMEDIATE INFERENCE

Section 1. Inference — its kinds

Inference is the process of passing from something that is given to something that is not given. The name inference is applied both to the process of inferring and to the propositions inferred. In the introductory chapter we have seen that inference is either deductive or inductive (Refer Chapter I Sec. 2).

Deductive inference is of two kinds. They are :

(a) Immediate inference and
(b) Mediate inference.

In immediate inference we pass from a single given proposition to another proposition directly or immediately. 'Immediate' here does not mean 'quick', but means 'direct' or 'without' a middle or common term'. If one premise (proposition) is sufficient for drawing a conclusion (another proposition) the process is called immediate inference. In short, immediate inference is the process which directly brings out the implications of a single given proposition.

Immediate inference is of two kinds. They are :

(a) Immediate inference by Opposition and
(b) Immediate inference by Eduction.

We will discuss these types in detail in the next sections that follow.

Mediate inference is a form of reasoning in which a conclusion is reached indirectly or mediately. The conclusion is reached after

comparing the given propositions with one another. The syllogism is the simplest form of mediate inference. In a syllogism a conclusion is drawn or inferred from two premises. The conclusion is reached by comparing the two premises, through a mediating term.

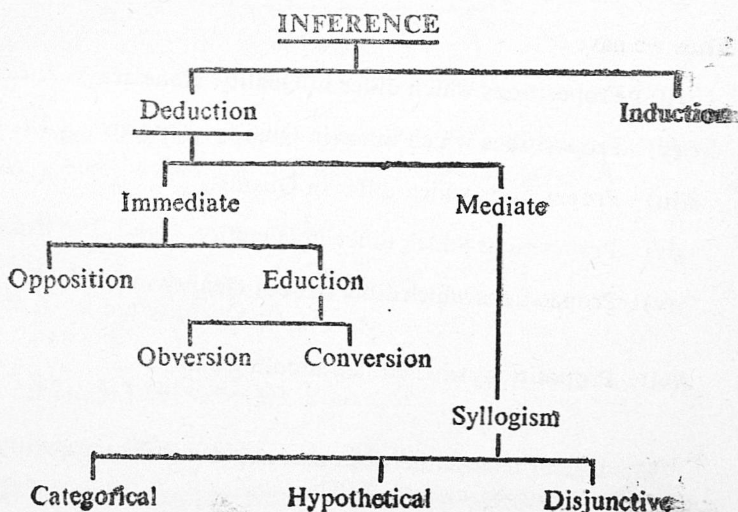
Syllogisms are of three kinds. They are :

(a) The Categorical Syllogism
(b) The Hypothetical Syllogism and
(c) The Disjunctive Syllogism.

Now, we may represent the definition of inference and the distinction between immediate inference and mediate inference as shown under :

Inference	Immediate Inference	Mediate Inference (Syllogism)
Premise ↓ Conclusion	One Premise ↓ Conclusion (without a medium)	Two Premises ↓ Conclusion (through a medium)

The classification of inference may be represented as follows:



Section 2. Immediate Inference by Opposition

Opposition is the process of immediate inference in which we infer, from a single given proposition, the truth and the falsity of other propositions having the same subject and the same predicate as the original proposition, but differing from it in quality alone, or in quantity alone or in both quality and quantity. In logic, to 'oppose' propositions means to affirm and deny the same predicate of the same subject. Opposition is thus a logical relationship.

		S		P
A	All	men	are	bipeds
E	No	men	are	bipeds
I	Some	men	are	bipeds
O	Some	men	are not	bipeds

The above propositions have the same subject and the same predicate. But if we take any two of them they differ in quality alone or in quantity alone or in both.

Thus we have :

(i) Propositions which differ in Quality alone are A & E

(ii) Propositions which differ in Quality alone are I & O

(iii) Propositions which differ in Quantity ,, ,, A & I

(iv) Propositions which differ in Quantity ,, ,, E & O

(v) Propositions which differ in both Quality & Quantity are A & O

(vi) Propositions which differ in both Quality & Quantity are E & I

The logical relation between universals of different quality is called *Contrary opposition* (A & E)

The logical relation between particulars of different quality is called *Subcontrary opposition* (I & O).

The logical relation between a universal and a particular of the same quality is called *Subaltern opposition* (A & I ; E & O).

The logical relation between a universal and a particular of different quality is called *Contradictory opposition* (A & O ; E & I).

Thus logical opposition is of four kinds. The four kinds of opposition between A, E, I, and O propositions are illustrated in what is known as the *Square of Opposition*.

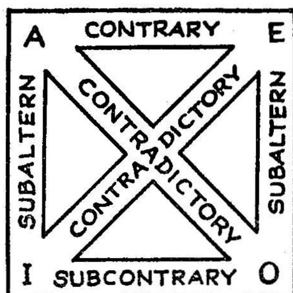


Fig. 6

A and E are in contrary opposition. They differ in quality only. A is the contrary of E and E is the contrary of A.

A All | men | are | bipeds.

E No | men | are | bipeds.

Of contraries,

If one is true, the other is false; and

If one is false, the other is doubtful.

Both of them cannot be true, but both may be false.

I and O are in subcontrary opposition. They differ in quality only. I is the subcontrary of O and O is the subcontrary of I.

I Some | men | are | bipeds.
O Some | men | are not | bipeds.

Of subcontraries,

If one is true, the other is doubtful; and
If one is false, the other is true.
Both of them may be true, but both cannot be false.

A and O are in contradictory opposition. Similarly E and I. They differ both in quality and in quantity. A is the contradictory of O and O is the contradictory of A; E is the contradictory of I and I is the contradictory of E.

A All | men | are | bipeds
O Some | men | are not | bipeds

E No | men | are | bipeds
I Some | men | are | bipeds

Of contradictories,

If one is true, the other is false;
and if one is false, the other is true.
Both of them cannot be true, nor can they both be false.

A and I are in Subaltern opposition. Similarly E and O. They differ in quantity only. The universal is called the subalternant and the particular is called the subalternate. The two propositions taken together are called subalterns.

A is the subaltern of I; I is the subaltern of A; E is the subaltern of O; and O is the subaltern of E.

A All | men | are | bipeds.
I Some | men | are | bipeds.

E No | men | are | bipeds.
O Some | men | are not | bipeds.

Of subalterns,

If the universal is true, the particular is true;
If the universal is false, the particular is doubtful;
If the particular is true, the universal is doubtful;
If the particular is false, the universal is false.
Both of them may be true and both may be false.

Note : 1. The truth value of the logical opposites may be summarized in the table below. This truth table will help us to find out mechanically from the truth or falsity of any given proposition, the truth, or falsity or doubtfulness of its opposites. Setting out the table using T or t for truth, F or f or false, d for doubtful we have the following **Truth Table :**

TRUE SIDE	A	E	I	O	FALSE SIDE
A	T	f	t	F	O
E	f	T	F	t	I
I	d	F	T	d	E
O	F	d	d	T	A

Fig. 7

1. Instructions for drawing this table :

(a) Draw 16 small squares as shown, and then write on the top of the square from left to right A,E,I and O; (this is the Basis side). On the left side write A,E,I and O from top to bottom (this is the True side); and on the right side write A,E,I and O starting from bottom to the top (this is the False side).

(b) After this, from the left hand top corner start writing diagonally T in capital letters.

(c) Then from right hand top corner square start writing diagonally F in the capital letters.

(d) Now in the lower half and in the upper half of the square some small squares are left blank. Fill up the lower half blank squares with 'd' in small letters. Similarly fill up the upper half blank squares with 't' or 'f' in small letters.

2. How to use the table ?

(a) A certain proposition is given as true (for e.g., E) the given proposition from the Basis side and the True side interesect at T. Read from left to right for the truth value of its opposites. (If E is true, A is f, I is F and O is t).

(b) A certain proposition is given as false. (for e.g., I) the given proposition from the Basis side and the False side intersect at F. Read from left to right for the truth value of its opposites. (If I is false A is f, E is T and O is t).

Note 2. Logical opposition for singular propositions: In the case of singular propositions, there can be no subcontrary or subaltern opposition. For, the subject of a singular proposition cannot have particular quantity. It can have only contrary opposition. Its contradictory opposition is the same as the contrary opposition. That is, the contrary and the contradictory of a singular proposition coincide. For example, the contrary and contradictory of the proposition 'Jimmy is my dog' is 'Jimmy is not my dog'. Thus the contrary and contradictory of the singular proposition are the same.

Note 3. The distinction between contrary and contradictory opposition: *Contrary propositions admit of a mean or middle ground.* That is between contrary propositions there is an intermediate stage. On the other hand, *in contradictory propositions there is no middle course left,* for they differ both in quality and in quantity. The contradictory of a proposition denies that it is wholly true. But the contrary asserts that it is wholly false. Hence a contradictory opposite is more easily defended and more difficult to refute in argument than a contrary opposite.

Suppose some one maintains that 'all sweet things are fruits'. It would be easy to prove the contradictory 'some sweet things are

not fruits' than the contrary 'no sweet things are fruits'. Even a single instance of a sweet thing which is not a fruit is enough to overthrow the given universal proposition. If the contrary were used by way of reply (say 'no sweet things are fruits') it would be easy for the man who made the statement that 'all sweet things are fruits', to refuse this contrary (no sweet things are fruits) by its contradictory (some sweet things are fruits). Hence whenever we want to overthrow a given statement we prefer its contradictory and not its contrary.

Section 3. Immediate Inference by Eduction

The word 'eduction' comes from the Latin root 'to educe' which means 'to draw out'. *Eduction, is therefore a process of inferring of drawing out directly the implications of a given proposition. There are two primary forms of eduction: They are: (a) obversion and (b) conversion.*

In both obversion and conversion we derive from a given proposition (or original) a second statement which is consistent in meaning with the original. That is, the inferred statement, though it differs from the original in form, does not differ in its meaning. So. if the given proposition is true, the inferred is also true.

The main advantage of eduction lies in its clarification of the implications of propositions.

(A) Obversion (Permutation or Equipollence)

Obversion is the process of passing from one proposition to another proposition which is equivalent to it. It is a different way (form) of rendering the same assertion (idea) that the original proposition expressed.

Obversion is the process of changing the quality of the proposition without changing the meaning. The given proposition is called the obvertend and the inferred proposition is called the *obverse* and the process itself is called *obversion.*

The rules of obversion are :—

(i) Retain the subject of the obvertend.

(ii) Retain the quantity of the obvertend.

(iii) Change the quality.

(iv) Use the contradictory of the predicate of the obvertend as the new predicate.

Thus to obvert a proposition is to state negatively what the original proposition stated affirmatively or to state affirmatively what the original proposition stated negatively. In obversion we infer from a proposition of the form S – P another proposition of the form S – non P. (The contradictory of P is referred to as non-P. A dash (′) on the top of any letter stands for its contractitory i.e. non–P = P′).

The following diagram indicates the changes to be effected by obversion :

S	affirmative ↓	P	S	negative ↓	P
S	negative	non-P	S	affirmative	non-P

Now let us apply the rules of obversion to A,E,I and O propositions.

(a) Universal Affirmative or A proposition

Obvertend : A All | dogs (S) | are | quadrupeds. (P)

All | S | is | P or S a P

Obverse : E No | dogs (S) | are | non-quadrupeds. (non-P)

No | S | is | non-P or S e P′

The obverse of S a P is S e P′

(b) Universal Negative or E proposition

Obvertend : E No | squares (S) | are | rounds. (P)

No S | is | P or S e P

Obverse : A All | squares (S) | are | non-rounds. (non-P)

All | S | is | non-P or S a P'

The obverse of S e P is S a P'

(c) Particular Affirmative or I proposition

Obvertend: I Some | men (S) | are | teachers. (P)

Some | S | is | P or S i P

Obverse : O Some | men (S) | are not | non-teachers. (non-P)

Some | S | is not | non-P or S o P'

The obverse of S i P is S o P'

(d) Particular Negative or O proposition

Obvertend : O Some | ministers (S) | are not | women. (P)

Some | S | is not | P or S o P

Obverse : I Some | ministers (S) | are | non-women. (non-P)

Some | S | is | non P or S i P'

The obverse of S o P is S i P'

The tabulated results of obversion :

Original or obvertend	Obverse
1. All S is P or S a P	No S is non-P or S e P′
2. No S is P or S e P	All S is non-P or S a P′
3. Some S is P or S i P	Some S is not non-P or S o P′
4. Some S is not P or S o P	Some S is non-P or S i P′

Note : **Obversion of Singular propositions**

Singular propositions are obverted in the following manner:

Obvertend : A Kalidasa | is | one who wrote Sakuntalam.

Obverse : E Kalidasa | is not | one who did not write Sakuntalam

(B) Conversion

Conversion is a process of passing from one proposition to another proposition which is equivalent to it. It is a different way (form) of rendering the same assertion that the original proposition expressed.

Conversion is the process of transposing the subject and the predicate of a given proposition without changing the quality. The given proposition is called the convertend, the inferred proposition is called the converse and the process itself is called conversion.

The rules of conversion are :

(i) Interchange the subject and the predicate terms.

(ii) If a term is not distributed in the convertend (original) it should not be distributed in the converse.

(iii) Do not change the quality of the convertend (The second rule is the real rule of conversion).

Thus to convert a proposition is to re-express it by interchanging the subject and predicate terms, taking into account the distribution of terms in the proposition. In conversion, we infer from a proposition of the form S-P another proposition of the form P-S.

The following diagram indicates the change to be effected in conversion:

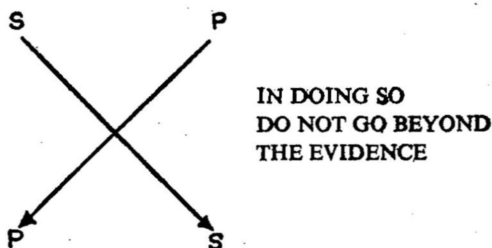


Fig. 8

If we violate the rule that if a term is not distributed in the convertend it must not be distributed in the converse, we commit a mistake known as the fallacy of illicit (illogical) conversion.*

Conversion is of two types: (a) simple conversion and (b) conversion by limitation.

(a) Simple conversion is the process of interchanging the subject and the predicate of the given proposition without any other change. Both E and I propositions are converted in this way.

Universal Negative or E proposition

Convertend : E No | $\underset{S}{\underline{\text{snails}}}$ | are | $\underset{S}{\underline{\text{vertebrates.}}}$

No | S | is | P or S e P

---

* A fallacy is an invalid argument. It is a mistake in reasoning. It is an unintentional mistake in reasoning while 'sophism' is a mistake in reasoning deliberately calculated to deceive.

Converse : E No | Vertebrates (P) | are | snails. (S)

No | P | is | S or P e S.

Diagramatic representation :

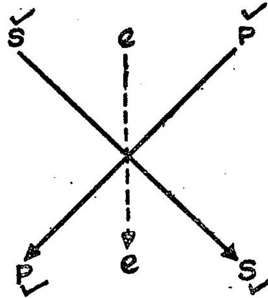


Fig. 9

In this process, here we have not gone beyond the evidence. Hence the converse of S e P is P e S.

Particular Affirmative or I proposition

Convertend : I Some | metals (S) | are | white things. (P)

Some | S | is | P or S i P

Converse : I Some | white things (P) | are | metals. (S)

Some | P | is | S or P i S

Diagramatic representation:

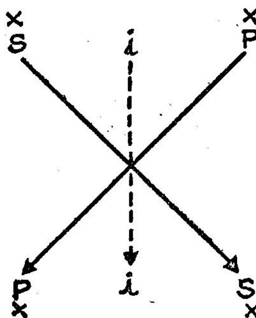


Fig. 10

In this process, here we have not gone beyond the evidence. Hence the converse of S i P is P i S.

(b) Conversion by Limitation

This process is also called conversion per accidens, accidental conversion, limited conversion or reduced conversion.

Proposition A is converted by this method.

Universal Affirmative or A proposition

Convertend : A All | fruits (S) | are | sweet things (P)

All | S | is | P or S a P

If we convert this proposition simply, we will be committing the fallacy of illicit conversion.

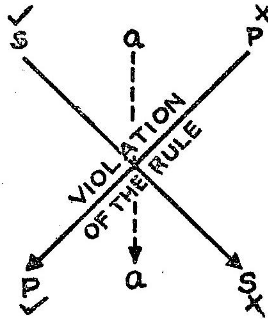


Fig. 11

P which is not distributed in the original will be distributed in the converse. This is a violation of the rule of conversion which says that if a term is not distributed in the convertend it should not be distributed in the converse. Therefore P which is not distributed in the original should remain undistributed in the converse also, where it takes the place (position) of the subject. Only particular propositions do not distribute their subjects. Hence

proposition A loses its quantity (universal) and becomes I. Since we are limiting the quantity of the converse from universal to particular, this process is called conversion by limitation. Therefore, the converse of

A All | fruits (S) | are | sweet things (P) is

I Some | sweet things (P) | are | fruits (S)

Some | P | is | S or P i S

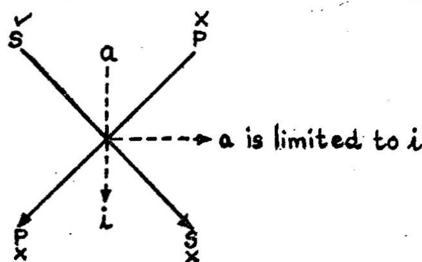


Fig. 12

Hence the converse of S a P is P i S

(c) Proposition O does not admit of conversion

Let us take an example.

Convertend : | Some men (S) | are not | philosophers (P)

Some | S | is not | P or S o P

If we convert this proposition it will be,

O Some | philosophers (P) | are not | men (S)

This is absurd. In the original proposition S is not distributed being the subject of a particular proposition. But in the converse, it is distributed being the predicate of a negative proposition. This is a violation of the rule of conversion that if a term is not distributed in the convertend it should not be distributed in the converse. We cannot limit the predicate by changing the quality from negative to affirmative for two reasons. (i) we should not change the quality of the convertend. This is the rule; and (ii) if we limit the quality, the meaning of the proposition is changed. Thus the inconvertability of O is due to the general principle of inference that one should not go beyond the evidence. If we convert O proposition we will be committing the fallacy of illogical conversion.

Fig. 13

Hence S o P has no converse.

Note: *Exception of A proposition* where simple conversion is possible. Proposition A can be converted simply in cases where the subject and the predicate terms have the same denotation, i.e. where S = P. In such cases both the terms are distributed. Hence simple conversion is possible. Example :

Converted : A All | human beings (S) | are | rational animals. (P)

S a P

Converse : A | All rational animals (P) | are | human beings (S)

P a S

The tabulated result of conversion :

Original or convertend	Converse	Nature of Conversion
1. All S is P or S a P	Some P is S or P i S	Limited
2. No S is P or S e P	No P is S or P e S	Simple
3. Some S is P or S i P	Some P is S or P i S	Simple
4. Some S is not P or S o P	Conversion is not logically possible	

(C) Difference between opposition and eduction

(a) In opposition the subject and the predicate are the same as the original. But in eduction the subject and the predicate of the educts are different from the orginal propositions.

(b) In opposition the meaning may undergo a change. But in eduction the meaning remains the same. That is, in eduction there is only change of form but there is no change in the meaning.

(c) In opposition the truth or falsity of the inferred propositions is derived from the truth or falsity of the original. That is, if the original is true, its opposite need not necessarily be true. But in eduction if the original is true, the educts are necessarily true.

(d) Eduction is different from opposition in its purpose.

(i) Eduction brings to light every aspect of a given proposition.

(ii) Eduction gives several substitutes for the original proposition.

1. Summary of the results of obsersion and conversion.

Original	Observe	Converse
S-P	S-P'	P-S
S a P	S e P'	P i S
S e P	S e P'	P e S
S i P	S o P'	P i S
S o P	S i P'	Nil

2. Brief rules of obversion and conversion:

Obversion	Conversion
a. Retain S and P.	a. Interchange S and P.
b. Change Quality.	b. Retain quality.
c. Use the contradictory of the original predicate.	c. Do not extend any term.

(D) Other Educts

In addition to obversion and conversion there and five educts. These are obtained by repeated alternate applications of the process of obversion and conversion. They are :—

(i) Obverted converse.

(ii) Partial contrapositive.

(iii) Full contrapositive.

(iv) Partial inverse.

(v) Full inverse.

If we first convert a proposition and then obvert it, we get what is known as *obverted conversion.*

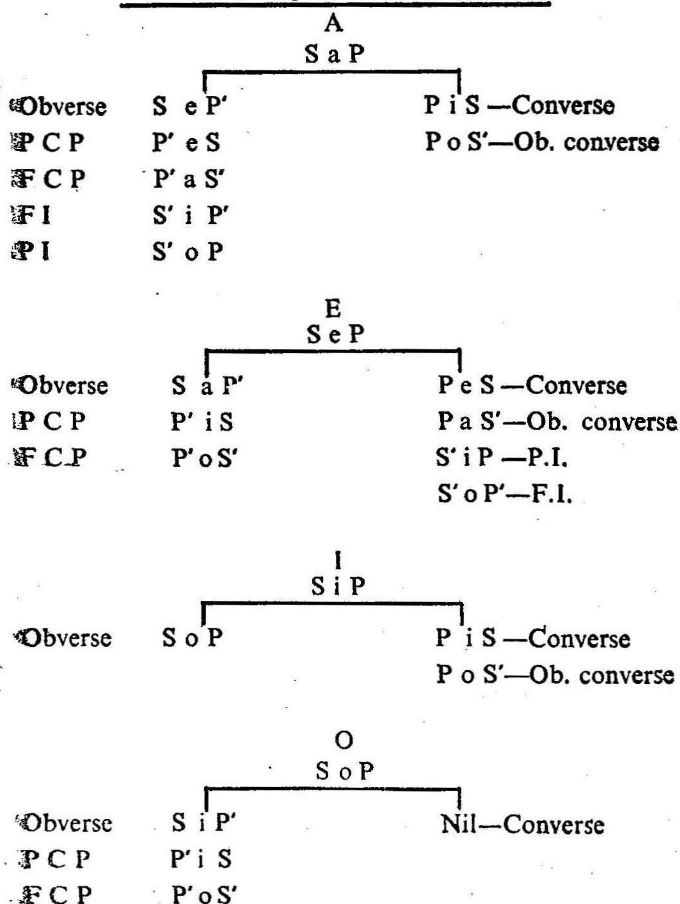
Contraposition is a process of immediate inference in which from a given proposition, we infer another proposition having the contradictory of the original predicate (non-P or P') for its subject, Contraposition consists in converting the obverse. To get the contrapositive we must first obvert and then convert the given proposition. The converted obverse of a given proposition is called partial contrapositive. If we obvert the partial contrapos-tive we get full contrapositive.

Inversion is a process of immediate inference in which from a given proposition we infer another proposition having the con-

tradictory of the original subject (non-S or S') as its new subject. To get the inverse we convert either the obverted converse or the full contrapositive of the original.

To obtain these educts from A, E, I and O propositions, we have to apply the processes of obversion and conversion alternately until we come to an O proposition requiring to be converted. Since this is impossible, the process of eduction comes to a natural stop.

Eduction of Popositions A, E, I and O



Scheme of Eduction

Nomenclature	Propositions			
	A	E	I	O
Original	S a P	S e P	S i P	S o P
Obverse	S e P'	S a P'	S o P'	S i P'
Converse	P i S	P e S	P i S	—
Obverted converse	P o S'	P a S'	P o S'	—
Partial contrapositive	P' e S	P' i S	—	P' i S
Full contrapositive	P' a S'	P' o S'	—	P' o S'
Partial inverse	S' o P	S' i P	—	—
Full inverse	S' i P'	S' o P'	—	—

Section 4. Material Immediate Inferences

(A) Immediate inference by added determinants

This is a process of drawing inferences from a given proposition by adding the same adjective (determinant) to both S and P. The inference will be valid if it has the same meaning in both places.

Examples of valid inferences:

1. All metals are elements.
∴ All heavy metals are heavy elements.

2. A dog is an animal.
∴ A faithful dog is a faithful animal

3. The cow is an animal.
∴ A white cow is a white animal.

Examples of invalid inferences:

1. A teacher is a man.
∴ A bad teacher is a bad man.

2. A lawyer is a man.
∴ A good lawyer is a good man.

3. An ant is an animal.
∴ A big ant is a big animal.

4. A cottage is a building.
∴ A huge cottage is a huge building.

(B) Immediate inference by complex conception

Immediate inference by complex conception is obtained (got) by adding the S and P of the given proposition to some other term. Then conceptions (ideas) more complex than the original S and P are formed.

Examples of valid inferences;

1. A horse is a quadruped.
∴ The head of a horse is the head of a quadruped.

2. Physics is a science
∴ Physical treatises are scientific treatises.

Examples of fallacious inferences;

1. A cow is not a horse.
∴ The owner of a cow is not the owner of a horse.

2. All judges are lawyers.
∴ A majority of Judges is a majority of lawyers.

3. All novels are false.
∴ A lover of novels is a lover of falsehood.

4. An ant is an animal.
∴ A large number of ants is a large number of animals.

(C) Immediate inference by converse relation

In this kind of inference we pass from a given statement to its correlative.

Examples:

1. A is the grandfather of B.
∴ B is the grandchild of A.

2. A is north east of B.
∴ B is south west of A.

3. A is younger than B.
∴ B is older than A.

Section 5. Does Immediate Inference deserve to be called Inference Proper?

In immediate inference we pass directly or immediately from one proposition to another; e.g., "All men are mortal" is true. Therefore, "Some mortal being are men" is true.

Some logicians hold th at immediate inference is not inference proper. According to Mill, 'it is nothing but equipollency or equivalence of propositions'. He means that it involves nothing but verbal transformation. He calls 'inference improperly so called' and goes on to say: "In these cases, there is not really an inference, there is in the conclusion no new truth. . . . The fact asserted in the conclusion is either the very same fact or part of the fact asserted in the original propositions". Bain says that in immediate inference there is merely the transition from one wording to another wording of the same fact. Mill and Bain think that novelty is the most important characteristics of inference.

Logicians like Bosanquet, however, do not insist on novelty. According to them necessity is essential for inference. For example, we pass from 'all men are mortal' to 'some mortal beings are men'. We do so because the latter necessarily follows from the former. Inference is a process of showing the relation of fa cts to one

another. Facts are necessarily related as parts of a system. Necessity is, therefore, the characteristic of system and system is the basis of inference.

Conclusion: Mill and Bain are wrong in saying that immediate inferences are mere verbal changes and that they simply express the original proposition in different words. The process of immediate inference does not appear to be merely verbal. It involves a fuller and a clearer understanding of the hidden implications of the given propositions. There is, therefore, something new. Creighton and Smart have said : "... Whether or not they may properly be called inferences they render important services by helping us to understand all that is really implied both in the way of affirmation and denial in the propositions we use". Nothing is commonerin argument than disputes as to what certain statements imply. Such quarrels can be settled only by employing the process of immediate inference which may be described as the method of logical interpretation. Given a certain proposition as true or false, what other propositions can be immediately derived from it ? Immediate inferences alone can determine what other propositions, affirmative and negative, are really involved in the given proposition. Hence immediate inference deserves to be called inference proper.

Model Exercises

Note 1. Before working out these exercises remember the following:

(a) The two way rules of distribution.
(b) The square of opposition.
(c) The truth table square (of opposition).
(d) The scheme of eduction.

Note 2. Always reduce the given sentence (If it is not in the logical form to the logical form us.ng the appropriate symbol).

Note 3. Then use symbolic dictionary (whereevr applicaebl) i.e. indicate what S stands for, what P stands for, what S' stands for, and what P' stands for. This symbolic dictionary (S.D.) will help one to work out the excercises quickly.

Note 4. In the case of educts, if the original is true, all its educts are true.

Model exercise worked out :

Model I : *If proposition A is true, what can you say about its logical opposites ?*

Answer Original : Proposition A. It is true.

The contrary of A is E.

This is false.

The subaltern of A is I.

This is true.

The contradictory of A is O.

This is false.

A has no subcontrary.

Model II: *Given that 'no kings are rich' is false, what can you say, about its logical opposites?*

Answer · Original L.F.E. No | kings (S) | are | rich persons. (P)

This is S e P. This is false.

S.D. S = kings; P = rich persons P' = non rich persons.

The contrary of S e P is S a P.

A All | kings | are | rich persons.
This is doubtful.

The subaltern of S e P is S o p.

O Some | kings | are not | rich persons.
This is doubtful.

The contradictory of S e P is S i P.

I Some | kings | are | rich persons.
This is true.

S e P has no subcontrary.

Model III : *Give, wherever possible, the contrary, converse, subaltern, obverse, contradictory and subcontrary of : 'Every dog is a quadruped'.*

Answer : Original L.F. A All | dogs (S) | are | quadrupeds (P)

This is S a P

S.D. S = Dogs; P = quadrupeds; P′ = non-quadrupeds

The contrary of S a P is S e P

E No | dogs | are | quadrupeds.

The subalern of S a P is S i P.

I Some | dogs | are | quadrupeds.

The contradictory of S a P is S o P

O Some | dogs | are not | quadrupeds.

The obverse of S a P is S e P′

E No | dogs | are | non-quadrupeds.

The converse of S a P is P i S.

I Some | quadrupeds | are | dogs.

S a P has no sub-contrary.

Model IV : *Give, where possible, the obverse, converse, obverted converse, contrapositive, inverse, contrary, subaltern and contradictory of the following proposition and comment on their truth value : No birds are mammals.*

Answer : Original ; L.F. E No | birds (S) | are | mammals. (P)

This is S e P. This is true.

S.D. S = birds; S′ = non-birds; P = mammals; P′ = non-mammals.

The *obverse* of S e P is S a P′.

A All | birds (S) | are | non-mammals (P').

This is true.

The *converse* of S e P is P e S.

E No | mammals (P) | are | birds (S).

This is true.

The *obverted converse* of S e P is P a S'.

A All | mammals (P) | are | non-birds (S').

This is true.

The *partial contrapositive* of S e P is P' i S.

I Some | non-mammals (P') | are | birds (S).

This is true.

The *full contrapositive* of S e P is P' o S'

Some | non-mammals (P') | are not | non-birds (S').

This is true.

The *partial inverse* of S e P is S' i P

I Some | non-birds (S') | are | mammals (P').

This is true.

The *full inverse* of S e P is S' o P'

O Some | non-birds (S') | are not | non-mammals (P').

This is true.

The *contrary* of S e P is S a P.

A All | birds (S) | are | mammals. (P)

This is false.

The *contradictory* of S e p is S i P.

I Some | birds (S) | are | mammals. (P)

This is false.

The *subcontrary* of S e P is S o P.

O Some | birds | are not | mammals.

This is true.

Model V : *State the logical relationship between the first and each of the following propositions and comment on their truth value.*

1 A few politicians are patriots.

2. Some patriots are politicians.

3. Few politicians are patriots.

4. No politicians are patriots.

5. Some politicians are not non-patriots.

6. All politicians are patriots.

7. Some non-patriots are politicians.

8. Some non-patriots are not non-politicians.

Answer : 1. Original : I Some | politicians (S) | are | partiots. (P)

This is S i P. This is true.

S.D. S = politicians S' = non-politicians P = patriots
P' = non-patriots.

2. L.F. I Some | patriots (P) | are | politicians. (S)

This is P i S. This is the *converse* of the original (S i P) and hence true.

3. L.F. O Some | politicians | are not | partiots.
S P

This is S o P. This is the subcontray of the original (S i P) and hence doubtful.

4. L.F. No | politicians | are | partiots.
S P

This is S e P. This is the contradictory of the original (S i P) and hence false.

5. L.F. O Some | politicians | are not | non-patriots.
S P'

This is S o P'. This is the obverse of the original (S i P) and hence true.

6. L.F. A All | politicians | are | patriots
S P

This is S a P. This is the subaltern of the original (S i P) and hence doubtful.

7. L.F. I Some | non-patriots | are | politicians.
P' S

This is P' i S. This is the partial contrapositive of the original (S i P) and hence true.

8. L.F. O Some | non-patriots | are not | non-politicians
P' S'

This is P' o S'. This is the full contrapositive of the original (S i P) and hence true.

Model VI : *Granted 'All metals are elements' what can be said of (i) non-elements (ii) non-metals and (iii) elements.*

Answer : Original *A* All | metals (S) | are | elements. (P)

This is S a P.

S.D. S = metals; S' = non-metals; P = elements; P' = non-elements.

(i) Non-elements = P'.

The following inferences can be drawn with 'non-elements' or P' as the subject :

The partial contrapositive of S a P is P' e S.

E. No | non-elements | are | metals.

The full contraspositive of S a P is P' a S'.

A. All | non-elements | are | non-metals.

(ii) Non-metals = S'.

The following inferences can be drawn with 'non-metals', or S' as the subject.

The partial inverse of S a P is S' o P.

O Some | non-metals | are not | elements.

The full inverse of S a P is S' i P'.

I Some | non-metats | are | non-elements.

(iii) Elements = P.

The following inferences can be drawn with 'elements' or P as the subject.

The converse of S a P is P i S

I. Some | elements | are | metals.

The obverted converse of S a P is P o S'.

O Some | elements | are not | non-metals.

Exercises

1. From the truth of an E proposition determine the truth value of its opposites.

2. Given that I is true. what can be said of its opposites ?

3. With reference to opposition of propositions from the truth of an A proposition and the falsity of an O proposition determine the truth and falsity of their opposites.

4. If A is false what can you say about its logical opposites?

5. From the falsity of an I proposition determine the nature of its logical opposites.

6. Given that E is false, what can you say about its logical opposites?

7. Assuming O to be true determine its logical opposites.

8. If the proposition 'lawyers are men' is true, what can you say about its logical opposites?

9. From the truth of 'No birds are mammals' and the falsity of 'All graduates are teachers' derive the truth value of their logical opposites.

10. Granted that 'few metals are white' to be true, determine its logical opposites.

11. State the logical opposites of:

a. Women are teachers.

b. Few soldiers are patriots.

Assume the given to be false and comment on the truth value of the opposites.

12. Give, wherever possible, the contrary, converse, contradictory, subaltern, obverse, subcontrary, contrapositive and inverse of the following and comment on their truth value:

(a) Only members are admitte

(b) Elephants have four legs.d.*

(c) Few men are geniuses.

(d) Books are not chairs.

(e) A few MLAs are communists.

(f) Every crystal is a solid.

(g) No minor can vote.

(h) Some turn to folly.

13. With reference to opposition of propositions from the turth of an I proposition and the falsity of an E proposition determine the truth value of their opposites.

14. Give the observe, and wherever possible, the converse of the following :

(a) Most Indians are Hindus.

(b) Only a cad would do that.

(c) Horses are quadrupeds.

(d) A few congressmen are not ministers.

(e) Many cautious men are wise.

(f) No ink is white.

(g) A soldier is a man.

(h) Few Indians are educated

(i) All pleasant experiences are painless experiences

15. Give the logical relationship between the first and each of the following propositions and comment on their truth value:

(a) Only adults can vote (Take the E form).

(b) All non-adults can vote.

* Reduce exclusive proposition to the E form in immediate inference and to the A form in syllogism.

(c) No persons who can vote are non-adults.

(d) Some non-adults can vote.

(e) All non-adults are those who cannot vote.

(f) Some non-adults are not those who can vote.

16. Give the obverse, and wherever possible, the converse of the following:

(a) Brutus killed Caesar.

(b) Every man is a philosopher.

(c) Kamban was a great poet.

(d) All men are rational.

(e) All elephants are animals.

(f) Few men are talkative.

(g) Every plant is a living being.

(h) Mount Everest is the highest peak in the Himalayas.

17. Give, where possible, the obverse, converse, obverted converse, contrapositive and inverse of the following:

(a) Every crow is a bird.

(b) Men are not angels.

(c) Women are graduates.

(d) Men are not teachers.

(e) Only men speak.

18. Determine the logical relationship between the first and each of the following propositions and comment on their truth value:

(a) All crystals are solids.

(b) Some solids are crystals.

(c) Some crystals are not solids.

(d) Some crystals are not non-solids.

(e) Some solids are not crystals.

(f) All non-solids are non-crystals.

(g) Some non-solids are crystals.

(h) All non-crystals are non-solids.

(i) All non-crystals are solids.

(j) No non-solids are non-crystals.

19. What is the logical relation between the first and each of the following propositions? Comment on their truth value:

(a) Only the sensitive are sympathetic.

(b) Some sensitive people are not unsympathetic.

(c) All unsympathetic people are sensitive.

(d) No sensitive people are sympathetic.

(e) No unsympathetic people are insensitive.

(f) All sympathetic people are insensitive.

(g) Some unsympathetic people are not insensitive.

(h) Some insensitive people are sympathetic.

(i) No insensitive people are unsympathetic.

(j) Some sympathetic people are sensitive.

20. Test the following inferences :

(a) All lecturers are M.A.s. Therefore all M.A.s are lecturers.

Answer: Original : A All | lectuters (S) | are | M.A.s (P)

This is S a P.

Therefore A All | M.A.s (P) | are | lecturers. (S)

This is P a S.

This is a case of simple conversion of proposition A and this commits the fallacy of illogical conversion. Here

P which is not distributed in the original is distributed in the converse. According to the rule of conversion if a term is not distributed in the original it should not be distributed in the converse. Since the argument violates the rule, it is invalid.

(b) Some men are rich. Therefore few men are rich.

Answer: Original: I Some | men (S) | are | rich persons. (P)

This is S i P.

Therefore O Some | men (S) | are not | rich persons. (P)

This is S o P. This is the subcontrary of S i P and hence doubtful.

(c) Some persons who appeared for the examination are not those who passed. Therefore some persons who passed the examination are not those who appeared for it.

(d) All lions are carnivorous. Therefore no lions are non carnivorous.

(e) Every congressman wears khaddar. Therefore every one who wears khaddar is a congressmen.

(f) Few men are kings. So a few men are poor.

(g) Few men are rich. So a few men are poor.

(h) Few Indians are Hindus. Therefore few Hindus are Indians.

(i) All mathematicians are liable to have headaches. Hence all who are liable to have headaches are mathematicians.

(j) Some substances which do not possess gravity are immaterial entities. Hence some immaterial entities are substances which do not posses gravity.

(k) Few communists are Russians. Therefore some Russians are not communists.

(l) All mangoes are not sweet. So all sweet things are no mangoes.

(m) No scientist is an ignorant person. Therefore no ignorant person is a scientist.

(n) Some judges are not unjust. Hence a few judges are just.

(o) Every coal is an atom of carbon. I can safely conclude that a few atoms of carbon are coals.

(p) All bald men are sensitive. Therefore all sensitive people are bald.

(q) All scientific knowledge is organised. Therefore all organised knowledge is scientific.

(r) What ever I eat I see. Hence whatever I see I eat.

(s) No cow-killers are Hindus. Therefore a few non-Hindus are cow-killers.

(t) A little economy saves half the expense. Therefore greater economy saves all expense.

(u) A prisoner is a convict. Therefore a young prisoner is a young convict.

(v) Power corrupts. Therefore absolute power corrupts absolutely.

(w) Man is an animal. Therefore a fierce man is a fierce animal.

(x) Trichy is south of Tanjore. Therefore Tanjore is north of Trichy.

(y) A chicken is a bird. Therefore the neck of a chicken is the neck of a bird.

(z) Hindus are Indians. Therefore a leader of the Hindus is a leader of the Indians.

18. What is the simplest proposition which must be established in order to disprove the following statements ?

(a) Every college student is abnormal.

(b) No cabinet minister is a good speaker.

(c) A few allergies are curable.

(d) A few events are not uncaused.

(e) Teen-agers enjoy pop music.

19. Explain whether the following are correct or incorrect:

(a) If O is false A is doubtful.

(b) If E is false, O is false.

(c) If I is true A is true.

(d) If S o P is true P' o S' is true.

(e) If S a P is true, S e P' is false.

20. Draw the logical opposites and the educts of the following:

(a) No genius is an uncreative person.

(b) All nominalists are non-realists.

(c) A few fears are groundless.

(d) Few men who love computers love tneir wives.

(e) No child dislikes candy.

21. Convert the following propositions and state the peculiarities, if any, you notice in converting them:

(a) All graduates are allowed to wear the academic gown.

(b) Every Indian is free.

(c) A few convicts are not innocent.

(d) Every bachelor is unmarried.

(e) No finite being is perfect.

(f) All Popes are Italians.

(g) All children are young.

22. Draw as many inferences as possible from the following and classify them into those that are true, those that are false, and those that are doubtful:

(a) Every ballon is inflatable.

(b) A moron is never a creative person.

(c) A few European countries are Republics.

(d) Few mathematicians are physicists.

(e) All motor cycles are noise producers.

(f) All unthinkables are unknowables.

Questions

1. Distinguish carefully between contrary and contradictory opposition. Which would you prefer in order to overthrow a given statement? Give reasons.

2. Draw the square of opposition and explain it fully.

3. Explain and illustrate (a) simple conversion (b) limited conversion (c) illicit conversion.

4. What is conversion? Explain why O is inconvertible?

5. Define each of the four types of opposition. State the rules of each.

6. Distinguish between immediate inference and medicate inference.

7. What is meant by immediate inference and what are its main kinds?

8. What is the difference between inference by opposition of propositions and eduction?

9. What are the different kinds of opposition existing between A, E, I and O propositions?

10. Define contrary, contradictory, subaltern and subcontrary oppositions and give concrete example for each.

11. Define eduction. What are its forms ?

12. Define conversion and apply the rules to the four-fold scheme of categorical propositions.

13. Explain the following :

(a) Limited conversion.(b) illogical conversion. (c) inconvertability of O. (d) Simple conversion.

14. Define obversion and apply the rules to the four-fold scheme of categorical propositions.

15. What is meant by the obversion and conversion of a proposition ?

16. Explain opposition of propositions and examine whether singular propositions have logical opposites.

17. What is meant by conversion ? What are the two kinds of conversion ? Illustrate.

18. Explain the various forms of opposition. Which of them has the greatest value and why ?

19. Does inmediate inference deserve to be called inference proper ? Explain.

20. Explain the following material inferences :

(a) Inference by added determinants. (b) Inference by complex conception. (c) Inference by converse relation.

Chapter IV

THE CATEGORICAL SYLLOGISM

Section 1. Mediate inference — Syllogism

Mediate inference is the process of reasoning in which a conclusion is reached mediately or indirectly by comparing two or more premises. *Syllogism is the simplest form of mediate inference.*

e.g. All | good men | are | happy people.
All | unselfish men | are | good men.

∴ All | unselfish men | are | happy people.

The conclusion is reached indirectly by comparing the two propositions (premises) with one another. It is reached by comparing two terms with a third, common term. The common term mediates between the two terms and hence the conclusion is reached.

Thus *a syllogism is a complete argument.* It contains reasons and a conclusion derived from these reasons. An argument which contains the reasons and a conclusion is called a complete argument. Etymologically syllogism means 'thinking together.' A syllogism appeals to reason and compels assent.

Every syllogism, therefore, has two parts. One part contains the reasons and the other part contains the conclusion. The reasons

are called the premises. What is derived from the premises is called the conclusion, Hence a syllogism is a complete argument containing two permises and a conclusion.

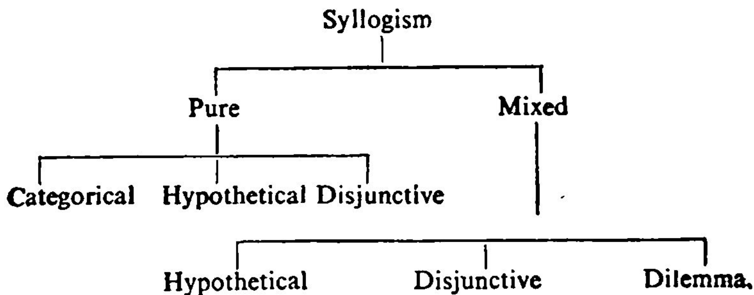
In every syllogism there are :

(i) a statement of a general principle
(ii) the application of the principle to an instance and
(iii) deduction of the consequence.

Thus *in a syllogism the prinicipIe of subsumption is used.* According to this principle a conclusion is obtained by bringing a fact under a general rule or universal. A syllogism is thus a test for consistency. In every day discourse we make use of several disguised syllogisms.

Section 2. Kinds of syllogism

Syllogisms are broadly classified into pure and mixed, depending upon the nature of the three propositions. If all the three propositions are of the same kind, it is a pure syllogism. If the three propositions are of different kinds then that syllogism is called a mixed one There are three kinds of pure and three kinds of mixed syllogisms.



In a pure categorical syllogism all the three propositions (the premises and the conclusion) are categorical.

In a pure hypothetical syllogism all the three propositions (the premises and the conclusion) are hypothetical.

In a pure disjunctive syllogism all the three propositions (the premises and the conclusion) are disjunctive.

In a mixed hypothetical syllogism one of the propositions is hypothetical and the other two are categorical propositions.

In a mixed disjunctive syllogism one of the propositions is disjunctive and the other two are categorical propositions.

In a dilemma we make use of a compound hypothetical for one premise, the other premise being a disjunctive proposition. The conclusion is either a disjunctive or a categorical proposition.

Section 3. The Categorical Syllogism

(A) The structure of the categorical syllogism

A categorical syllogism consists of two categorical propositions for its premises and a categorical proposition for its conclusion.

Example :

All | graduates | are | educated persons.
All | college teachers | are | graduates.

∴ All | college teachers | are | educated persons.

In this argument the first two propositions are called the premises and the last one is called the conclusion. In a syllogism the premises are taken to be true.

The subject of the conclusion is called the *minor term.* The predicate of the conclusion is called the *major term.* The premise which contains the major term is called the *major premise.* The premise which contains the minor term is called the *minor premise.* The term which is common to both the premises is called the *middle term.*

The major term occurs twice in the syllogism in the major premise and in the conclusion (but it does not occur in the minor premise).

The minor term occurs twice in the syllogism—in the minor premise and in the conclusion (but it does not occur in the major premise.)

The middle term occurs twice in the syllogism — in the major premise and in the minor premise (but it does not occur in the conclusion.)

Thus the terms, numerically six, are in fact three, each occurring twice in the syllogism. Thus the major premise contains the major and the middle terms. The minor premise contains the minor and middle terms and the conclusion contains the minor and the major terms.

The conclusion is reached by comparing the major term and the minor term with the middle term. The middle term mediates the major term and the minor term. Syllogistic reasoning hinges on the middle term. Therefore, this type of inference is called mediate inference.

A syllogism is a standard order in which the major premise is written first, the minor premise next and the conclusion last.

In a categorical syllogism the following symbols are used :

P — stands for the major term.
S — stands for the minor term.
M — stands for the middle term.

Example :

			M		P
Major Premise :	A	All	graduates	are	educated persons.
Minor Premise :	A	All	college teachers	are	graduates.
			S		M
Conclusion :	∴ A	All	college teachers	are	educated persons.
			S		P

Symbolic representation	All M is P	or	M a P.
	All S is M	or	S a M.
	All S is P	or	S a P.

(B) The figure of the syllogism depends on the position of the middle term in the premises. There are two premises. The middle

term occurs in both of them. It may occupy the place of the subject or the predicate in the premises. Therefore there are four ways of arranging the middle term. Thus there are *four figures.*

If the middle term takes the place of the subject in the major premise and predicate in the minor premise, the syllogism is said to be in the *first figure.*

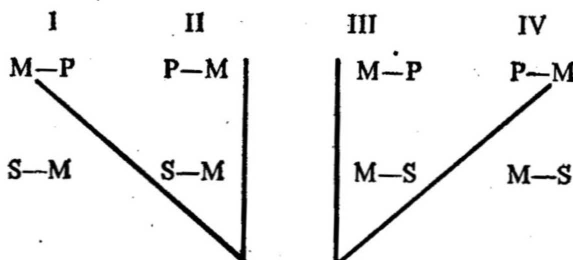
If the middle term takes the place of the predicate in both the premises the syllogism is said to be in the *second figure.*

If the middle term takes the place of the subject in both the premises the syllogism is said to be in the *third figure.*

If the middle term takes the place of the predicate in the major premise and subject in the minor premise, the syllogism is said to be in the *fourth figure.*

I Figure	II Figure	III Figure	IV Figure
M—P	P—M	M—P	P—M
S—M	S—M	M—S	M—S
S—P	S—P	S—P	S—P

It is easy to remember the position of M in the four figures if we think of its position as outlining the front of a shirt collar.



(C) The general rules of the Categorical Syllogism

There are eight rules, and these rules are called the axioms of validity. The eight rules have been classified and stated as follows.

(a) Rules relating to the structure of the syllogism

(Propositions and terms—their number and arrangement)

1. A categorical syllogism must consist of three and only three propositions, namely the major premise, the minor premise and the conclusion.

2. A categorical syllogism must contain three and only three terms, namely, the major term, the minor term and the middle term.

Each term must have the same meaning in both places in which it occurs.

(b) Rules relating to the distribution of terms in a syllogism

(The Quality or extension of terms)

3. The middle term must be distributed at least in one of the premises.

4. (a) If the major term is not distributed in the major premise it should not be distributed in the conclusion.

   (b) If the minor term is not distributed in the minor premise it should not be distributed in the conclusion.

(c) Rules relating to the quality of the syllogism

5. From two negative premises, no valid conclusion can be drawn. (At least one of the premises must be affirmative).

6. If one premise is negative the conclusion must be negative. (If the conclusion is negative one of the premises must be negative.)

(d) Corollaries

7. From two particular premises no valid conclusion can be drawn. (At least one of the premises must be universal.)

8. If one premise is particular the conclusion must be particular.

Note: The first four rules are called the rules of the terms of the categorical syllogism. The last four rules are called the rules of the propositions of the categorical syllogism

Warning : (With reference to rule (8)) If the conclusion is particular, one of the premises need not be particular. That is, when both the premises, are universal, we can get a particular conclusion. This is valid.

(D) Explanation and proof of the general rules

Rule 1. *A categorical syllogism must consist of three and only three propositions namely the major premise, the minor premise and the conclusion.*

This rule follows from the definition of the syllogism. The syllogism is a mediate inference in which the conclusion is derived from two given propositions. Hence, every syllogism must have three and only three propositions, the two premises and a conclusion. The important point here is that the two premises must have relation to each other. That is, they should not be unrelated. This rule is not really a rule to determine the validity of the syllogism but to determine whether an argument is in the form of the syllogism or not.

Rule 2. *A categorical syllogism must contain three and only three terms, the major term, the minor term and the middle term. Each term must have the same meaning in both places in which it occurs.*

The necessity of having only three terms follows from the very nature of a catagorical syllogism. The major term and the minor term, are related (either affirmatively or negatively) through the intermediary of a third term called the middle term The conclusion is drawn through the mediation of the common term. That is, the middle term serves as the point of comparison, as a common standard, between the major and the minor terms. If there is no middle term no valid conclusion can be drawn from the premises. Hence there must be three and only three terms in a syllogism (each occuring twice) the major term, the minor term and the term relating the two, viz, the middle term.

If there are four different terms in a syllogism we cannot mediate between the terms and hence no valid conclusion can be

drawn. A syllogism which contains four terms commits the *fallacy of four terms or quaternio Terminorun.*

Major Premise : A All | hens | are | those which come out of eggs.

Minor Premise : A All | eggs | are | those which come out of hens.

Conclusion : A All | eggs | are | those which come out of eggs.

The terms must have exactly the same meaning and must be used exactly in the same sense in both the places in which they occur in the syllogism. A term which has two different meanings is said to be an ambiguous term. Therefore, a term which has a different meaning in each occurence is equal to two different terms. If in a syllogism any term (whether it is the major term or the minor term or the middle term) is used in more than one sense there are in fact four terms. *Thus the ambiguity in a term is a disguised form of the fallacy of four terms.* We must, therefore, be on our guard especially against ambiguous middle terms.

The fallacy of ambiguous middle occurs if the middle term has one meaning in the major premise and another meaning in the minor premise.

Examples :

M P
1. A All | rulers | are | those who have authority.

A All | measuring sticks | are | rulers.
S M

∴ A All | measuring sticks | are | those which have authority.
S P

The different meanings of the middle term is obvious.

M P

2. A All | cases | are | boxes.

A All | those that are brought before the judges | are | cases.

S M

∴ A All those that are brought before the judges | are | boxes.

S P

Here the ambiguity of the middle term requires no explanation.

Thus, if any term is used in two different senses, then, in reality there are four terms. Therefore, no term should be used in an ambiguous sense in the syllogism. In other words, each term must have the same meaning in both the places in which it occurs.

Rule 3. *The middle term must be distributed at least in one of the premises.*

The middle term serves as a common point of reference for relating the major and the minor terms. It is the standard of comparison. Syllogistic reasoning hinges on the middle term. It is the cause or the ground of the conclusion. We can establish a relation between S and P in the conclusion only if they are related to one and the same part of M. This is possible only if M is taken in its entire extent or distribution at least once. If M is not distributed even once it will stand for a different protion of its extension in each premise. This will be equal to two different terms, and, therefore, it cannot fulfil its function of relating S and P. Let us give an example.

P M

A All | Buddhists | are | vegetarians.

A All | Jains | are | vegetarians.

S M

∴ A All | Jains | are | Buddhists.

S P

In this syllogism, the middle term is not distributed even once. If the middle term is not distributed even once it is a

violation of the rule, and is called *the fallacy of Undistributed Middle.* This fallacy is made clear by the following diagram:

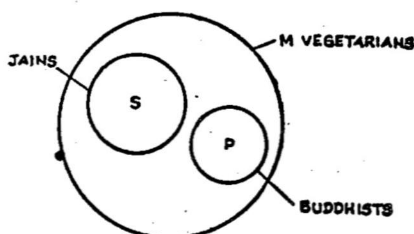


Fig. 14

It is clear from this diagram that we compare P with one part of M and S with another part of M. That is M stands for a different portion of its extension in each of the premises. Hence it does not relate or mediate S and P. Both S and P stand for 'vegetarians' but not the same 'vegetarian.'

Let us take another example:

M P
I Some | M L As | are | graduates.

A All | ministers | are | M L As.
S M

∴ A All | ministers | are | graduates.
S P

This syllogism may be represented as follows:

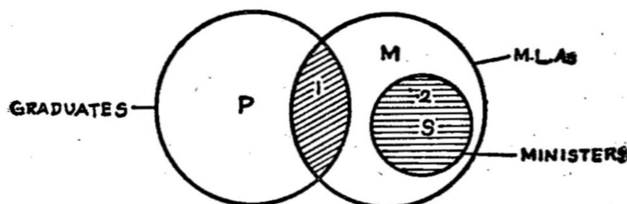


Fig. 15

The shaded porition No. 1. refers to the meaning of the major premise and the connection between P and M. The shaded

portion No. 2 refers to the meaning of the minor premise and the connections between S and M. In both the premises S and P are not being referred to the same part of M. Hence M is not acting as mediating term. As M is not distributed or taken in its full extension even once in the premises, it ceases to be the standard of comparison.

But, in the following example, the middle term mediates between S and P because it is taken in its entire extent or distribution :

	M		P
A	All | M. As | are | educated persons.		
A	All | lecturers | are | M. As.		
	S		M
∴ A	All | lecturers | are | educated persons.		
	S		P

This syllogism may be represented as follows:

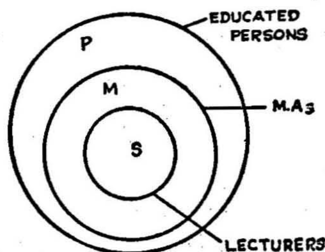


Fig. 16

As M is taken in its entire extent, it can mediate between S and P.

Hence it follows that the middle term must be distributed at least once.

Rule 4 (a) *If the major term is not distributed in the major premise, it should not be distributed in the conclusion.*

(b) *If the minor term is not distributed in the minor premise, it should not be distributed in the conclusion.*

The meaning or significance of these rules is that if a term is taken in a limited extent in its premise, we have no right to take it in its full extent in the conclusion. The conclusion cannot go beyond the premises. 'Do not go beyond the evidence.'

If the major term is distributed in the conclusion without being distributed in the major premise, the argument, *commits the fallacy of illicit major.*

Example :

			M		P		
A	All	|	cows	| are |	animals.		
E	No	|	cats	| are |	cows.		
			S		M		
E	No	|	cats	| are |	animals.		
			S		S		

The following diagram will help us to see why this syllogism is invalid :

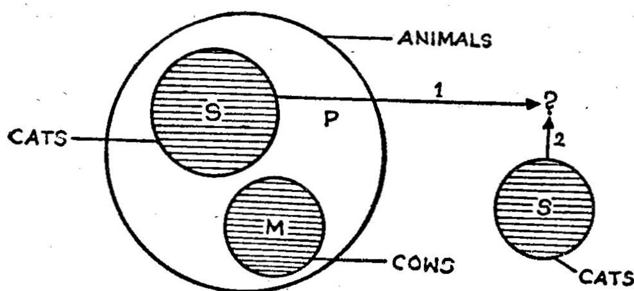


Fig. 17

M is included in P. (This is the meaning of the major premise.)
S is excluded from M. (this is the meaning of the minor premise.)

If S is excluded from M is it included in P or excluded from P ? We are in doubt. If S is also included in P (line 1) S is only a part of P as M is. That is P is not distributed. If S is excluded from P (line 2) we are not referring to P at all.

Therefore, there is no reference to the distribution of P. So we have no right to infer anything about P as a whole. We have no right to go beyond the evidence.

If the minor term is distributed in the conclusion without being distributed in the minor premise the argument commits *the fallacy of illicit minor.*

Example :

M P
A All | crows | are | black creatures.

A All | crows | are | birds.
M S

A All | birds | are | black creatures.
S P

The following diagram will help us to see why this syllogism is invalid :

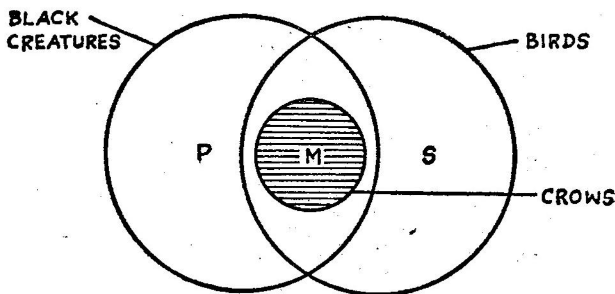


Fig. 18

The whole of M is a part of P. Similarly the whole of M is a part of S. From this we can conclude only that a part of S is a part of P but not that a part of P is in the whole of S. We are not referring to S as a whole. So we have no right to infer anything about S as a whole. We have no right to go beyond the evidence.

Hence, if a term is not distributed in its premise, it should not be distributed in the conclusion.

Rule 5. *From two negative premises no valid conclusion can be drawn. At least one of the premises must be affirmative..*

When both premises are negative neither S nor P has connection with M. To relate S and P in the conclusion M must itself be related with atleast one of them. If both premises are negative M is denied of this relation. So nothing can be said about the relation between S and P in the absence of their relation to M. Therefore no valid conclusion can be drawn.

M P
E No | fishes | are | mammals.

E No | whales | are | fishes.
S M

E No | whales | are | mammals.
S P

The following diagram will help us to see why this syllogism is invalid :

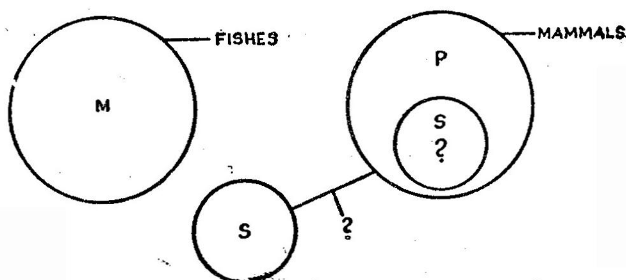


Fig. 19

M is excluded from P. (This is the meaning of the major premise), S is excluded from M. (This is the meaning of the minor premise). Now is S included in P or is it excluded from P? We are in doubt, So no definite (valid) conclusion can be drawn from the exclusion of M to S and from the exclusion of M to P.

Hence from two negative premises no valid conclusion can be drawn. To relate S and P in the conclusion M must be affirmed either of P or of S in the premises. Hence at least one of the premises must be affirmative.

If both the premises are negative the argument commits the fallacy of *two negative premises.*

Rule 6. *If one premise is negative the conclusion must be negative.*

Let us suppose that one premise is negative and the other affirmative. Then of P and S one agrees with M and the other does not. Therefore S and P cannot agree with each other in the conclusion. That is, 'S is not P'. Thus the conclusion is negative if one premise is negative.

Example :

P M
A All | ants | are | insects.

E No | spiders | are | insects.
S M

E No | spiders | are | ants.
S P

Rule 7. *From two particulars premises no valid conclusion can be drawn.*

Let us take the possible combinations of categorical syllogisms in which both the premises are particular propositions. The two particular propositions are I and O. They can be combined as follows :

Major premise . .	I	I	O	O
Minor premise :	I	O	I	O

In the $\left|\begin{matrix}I\\I\end{matrix}\right|$ combination no term is distributed, for an I proposition does not distribute any term. Therefore this combination commits the fallacy of undistributed middle. Therefore $\left|\begin{matrix}I\\I\end{matrix}\right|$ combination is invalid.

The $\left|\begin{matrix}O\\O\end{matrix}\right|$ combination commits the fallacy of two negative premises. Hence it is is invalid.

In the $\left|\begin{matrix}I\\O\end{matrix}\right|$ combination, since one of the premises is negative the conclusion becomes negative distributing the predicate, the major term (P.) In the major premise the major term is not distributed because the major premise is an I proposition which does not distribute any term. In this combination the major term is distributed in the conclusion without being distributed in the major premise. *This combination commits the fallacy of illicit major.* Therefore it is invalid.

In the $\left|\begin{matrix}O\\I\end{matrix}\right|$ combination since one of the premises is negative the conclusion becomes the negative, distributing the major term. So the major term must be distributed in the major premise. Since the minor premise is an I proposition it does not distribute any term. The middle term is, therefore, not distributed in it. So the middle term also must be distributed in the major premise. Now we have to distribute two terms P and M in the major premise which is an O proposition. O proposition distributes only one term and if we give this distribution to M the combination commits the fallacy of illicit major. On the other hand, if we give the distribution to P, the combination commits the fallacy of undistributed middle. *Hence either the fallacy of illicit major or the fallacy of undistributed middle will arise in the* $\left|\begin{matrix}O\\I\end{matrix}\right|$ *combination. Therefore this combination is invalid.*

Thus from two particular premises no valid conclusion can be drawn. An argument which contains two particular premises commits the fallacy of two particular premises because it indicates

either the fallacy of two negative premises or the fallacy of illicit major or the fallacy of undistributed middle.

Rule 8. *If one premise is particular the conclusion must he particular.*

Let us take possible combinations of categorical syllogisms in which one premise is particular and the other universal. The combinations are :

Major Premise :	A	A	E	E	I	I	O	O
Minor Premise :	I	O	I	O	A	E	A	E

Of these eight combinations we have to rule out the following :

E	O	and	I
O	E		E

The E/O and O/E combinations are invalid for they commit the fallacy of two negative premises.

The I/E combination is also invalid. Here since one premise is negative the conclusion becomes negative, distributing P. But P is not distributed in the major premise which is an I proposition which does not distribute any term. Hence this combination commits the fallacy of illicit major.

Omitting these three, following are the valid combinations and let us see what happens to the conclusion.

A	A	E	I	O
I	O	I	A	A

In the A/I and E/I combinations the minor term is not distributed in its premise because it is an I proposition. Therefore, the minor term must not be distributed in the conclusion where it is the subject. Only particular propositions do not distribute their subject terms. Therefore the conclusion must be particular.

In the $\begin{array}{|c|}I\\A\end{array}$ combination only one term is distributed and that must be M. Therefore, S is not distributed in its premise. Hence it should not be distributed in the conclusion where it is the subject. Only particular propositions do not distribute their subjects. Therefore the conclusion must be particular.

In the $\begin{array}{|c|}O\\A\end{array}$ and $\begin{array}{|c|}A\\O\end{array}$ combinations only two terms are distributed in each, the subject of A and the predicate of O. Of these two terms that are distributed one must be M, for M must be distributed at least once. The other term that is distributed must be P, because since one of the premises is negative the conclusion becomes negative, distributing P. To be distributed in the conclusion P must be distributed in the major premise. Therefore, in these two combinations, the minor term (S) is not distributed in its premise. Hence S should not be distributed in the conclusion where it is the subject. Only particular propositions do not distribute their subject terms. Therefore the conclusion must be particular.

Thus if one premise is particular, the conclusion must be particular.

The last two rules, rule seven and rule eight, are corollaries for they do not really add anything new to the rules. The violation of the corollaries indicates one of the three following fallacies i.e. undistributed middle, illicit major, illicit minor.

(E) Valid combinations derived

Combining A, E, I and O propositions we get the following sixteen possible moods (forms).

A	A	A	A	E	E	E	E	I	I	I	I	O	O	O	O
A	E	I	O	A	E	I	O	A	E	I	O	A	E	I	O

Some of these combinations are invalid for the following reasons.

From two negative premises no valid conclusion can be drawn. By applying this rule we eliminate

E	E	O
E	O	E

and

O
O

combinations

From two particular :premises no valid conclusion can be drawn. By this rule we eliminate

I	I	O
I	O	I

combinations.

Of the remaining nine combinations the

I
E

combination is invalid, for, as we have seen already, it commits the fallacy of illicit major.

Therefore, the valid combinations are the following.

A	A	A	A	E	E	I	O
A	E	I	O	A	I	A	A

Section 4. The special rules of the four figures

Special rules of the I figure :

1. The minor premise must be affirmative.

2. The major premise must be universal.

Position of Terms in figure I.

M — P

S — M

S — P

Proof of the First Rule : If the minor premise is not affirmative, it must be negative. If any premise is negative the conclusion will become negative distributing P or major term. Now we have to provide for the distribution of P in the major premise where it takes the place of predicate. Only negative propositions distribute their predicates. Therefore. the major premise must be negative. According to our assumption the minor premise is negative. But from two negative premises no

valid conclusion can be drawn. Therefore, our supposition that the minor premise is negative is wrong. Therefore, the minor premise must he affirmative. This method of indirect proof is based on the principle of the inconceivability of the opposite.

Proof of the Second Rule : According to the first rule the minor premise must be affirmative. An affirmative proposition does not distribute its predicate. Therefore M is undistributed in the minor premise. For the syllogism to be valid the middle term must be distributed at least once. Therefore we have to provide for the distribution of M in the major premise, where it takes the place of subject. Only universal propositions distribute their subjects. Therefore the major premise must be universal.

Special rules of the II figure :

1. One of the premises must be negative.
2. The major premise must be universal.

Position of terms in figures II

P — M

S — M

S — P

Proof of the First Rule : Middle term occupies the place of predicate in both premises. For the syllogism to be valid the middle term must be distributed in at least one of the premises. A negative proposition alone distributes its predicate. Therefore one of the premises must be negative.

Proof of the Second Rule : According to the first rule one of the premises must be negative. If any premise is negative, the conclusion will become negative distributing P. P ought not to be distributed in the conclusion unless it is already distributed in the major premise. P takes the place of the subject in the major premise. Only universal proposition distributes its subject. Therefore, the major premise must be universal.

Special rules of the III figure :

1. The minor premise must be affirmative.
2. The conclusion must be particular.

Position of term in Figure III

M — P

M — S

S — P

Proof of the First Rule : If the minor premise is not affirmative, it must be negative. If any premise is negative the conclusion will become negative distributing P or major term. Now we have to provide for the distribution of P in the major premise where it takes the place of predicate. Only negative propositions distribute their predicate. Therefore, the major premise must be negative. According to our assumption the minor premise is negative. But from two negative premises no conclusion can be drawn. Therefore our supposition that the minor premise is negative is wrong. Therefore the minor premise must be affirmative. This method of indirect proof is based on the principle of the inconceivability of the opposite.

Proof of the Second Rule : According to the first rule the minor premise must be affir-mative. S is predicate in the minor premise. An affirmative proposition does not distribute its predicate. Therefore, S will be undistributed in the minor premise. If a term is undistributed in its premise it ought not to be distributed in the conclusion. Therefore S will have to remain undistributed in the conclusion. where it takes the place of the subject. Particular proposition alone does not distribute its subject. Therefore the conclusion must be particular.

Special rules of the IV figure :

1. If any premise is negative, the major premise must be universal.

2. If the major premise is affirmative, the minor premise must be universal.

3. If the minor premise is affirmative, the conclusion must be particular.

Position of terms in figure IV

P — M

M — S

S – P

Proof of the First Rule : If any premise is negative the conclusion will become negative distributing P. P ought not to be distributed in the conclusion unless it is previously distributed in the major premise. Therefore we have to provide for the distribution of P in the major premise where it takes the place of the subject. Universal propositions alone distribute their subject. Therefore the major premise must be universal, if any premise is negative.

Proof of the Second Rule: : If the major premise is affirmative M will remain undistributed in the major premise. For an affirmative proposition does not distribute its predicate. For the syllogism to be valid M must be distributed at least once. Therefore, we have to provide for the distribution of M in the minor premise where it takes the place of the subject. Universal propositions alone distribute their subject. Therefore the minor premise must be universal if the Major premise is affirmative.

Proof of the Third Rule : Let the minor premise be affirmative. An affirmative proposition does not distribute its predicate. S which is predicate in the minor premise will, therefore, be undistributed. Therefore it has no right to be distributed in the conclusion. S takes the place of the subject in the conclusion. Particular proposition alone do not distribute their subjects. Therefore the conclusion must be particular, if the minor premise is affirmative.

Section 5. The moods

The mood is the form of a syllogism as determined by the quality and quantity of the premises and the conclusion. In other words, by the mood of the syllogism we mean the combination of propositions A,E,I and O which goes to make it up.

According to the general rules of the syllogism the following eight combinations are valid :

A	A	A	A	E	E	I	O
A	E	I	O	A	I	A	A

By applying the special rules of each figure to these combinations we get *the valid moods of the four figures.*

The valid combinations of the I figure are :

A	E	A	E
A	A	I	I
A	E	I	O

The valid combinations of the II figure are :

E	A	E	A
A	E	I	O
E	E	O	O

The valid combinations of the III figure are :

A	I	A	E	O	E
A	A	I	A	A	I
I		I	O	O	O

The valid combinations of the IV figure are :

A	A	I	E	E
A	E	A	A	I
I	E	I	O	O

The valid moods are conveniently remembered with the help of the following mnemonics.

Figure I	Barbara (A A A)	Celarent (E A E)	Darii (A I I)	Ferio (E I O)		
Figure II	Cesare (E A E)	Camestres (A E E)	Festino (E I O)	Baroco (A O O)		
Figure III	Darapti (A A I)	Disamis (I A I)	Datisi (A I I)	Felapton (E A O)	Bocardo (OAO)	Ferison (E I O)
Figure IV	Bramantip (A A I)	Camenes (A E E)	Dimaris (I A I)	Fesapo (E A O)	Fresison (E I O)	

A. The strengthened moods

A strengthened mood is one in which either the middle term is distributed twice or the major term is distributed in the premise but not in the conclusion.

Let us find out the moods in which M is distributed twice. M may be distributed twice when both premises may be affirmative. The two affirmative propositions are A and I. The I proposition does not distribute any term. Therefore both premises must be A and in each of them we should provide for the distribution of M. Therefore the syllogism will be as follows.

A — All M is P

A — All M is S   This is Darapti in figure III

I — Some S is P

Let us now consider the case in which one premise is negative. If any premise is negative the conclusion must be negative distributing P. P ought not to be distributed in the conclusion unless it is previously distributed in the major premise. Therefore, in the major premise we have to provide for the distribution of M and P. Therefore the major premise must be "No M is P" or "No P is M." Since the major premise is negative in quality. the minor premise must be affirmative in quality, For from two negative premises no valid conclusion can be drawn

The minor premise cannot be I because it does not distribute any term. Therefore it must be A. Therefore the minor premise must be "All M is S" The syllogisms are as follows.

E — No M is P.
A — All M is S. This is Felapton in Figure III

O Some S it not P.

E — No P is M.
A — All M is S. This is Fesapo in figure IV

O Some S is not P.

Let us now deduce the strengthened mood in which the major term is distributed in the major premise but not in the conclusion. Since P is not distributed in the conclusion, the conclusion must be affirmative in quality. To prove an affirmative conclusion, both premises must be affirmative, In the major premise, which is affirmative, we have to provide for the distribution of P. Therefore the major premise must be 'All P is M'. 'Being the predicate of an affirmative proposition M is undistributed in the major premise.' For the syllogism to be valid the middle term must be distributed at least once. Therefore we have to provide for the distribution of M in the minor premise which is also affirmative. Therefore the minor premise must be 'All M is S.' The syllogism is as follows :

A — All P is M.
A — All M is S. This is Bramantip in Figure IV

I — Some S is P.

B. Weakened moods

A weakened mood is one in which, while we are fully entitled to draw a universal conclusion, we choose to draw only the corresponding particular conclusion.

1. Instead of Barbara we can have Barbari.
2. Instead of Calarent we can have Celeront.

3. Instead of Cesare we can have Cesaro.
4. Instead of Camestres we can have Camestros.
5. Instead of Camenes we can have Camenos.

The weakened mood is also known as the subaltern mood.

Section 6. Fallacies of the Categorical Syllogism

Name / Nature of the fallacy.	The rule that is violated
1. Fallacy of four Terms	Every syllogism must contain three and only three terms.
2. Fallacy of Ambiguous Middle	No term should be used in an ambiguous sense.
3. Fallacy of Undistributed Middle	The middle term must be distributed at least once.
4. Fallacy of Illicit Major	If the major term is not distributed in the major premise, it should not be distributed in the conclusion.
5. Fallacy of Illicit Minor	If the minor term is not distributed in the minor premise, it should not be distributed in the conclusion.
6. Fallacy of Two Negative Premises	From two negative premises no valid conclusion can be drawn.
7. An affirmative conclusion with a negative premise	If one premise is negative the conclusion must be negative.
8. A negative conclusion when both premises are affirmative	If the conclusion is negative, one of the premises must be negative.
9. Fallacy of Two particular Premises leading to either (a) Two Negative premises or (b) Undistributed Middle or (c) Illicit Major	From two particular premises no valid conclusion can be drawn.

Section 7. Enthymeme

An enthymeme is a condensed argument in which either one of the premises or the conclusion is omitted. It is a shortened or abbreviated or abridged syllogism.

If the major premise is omitted it is known as the enthymeme of the *first order.*

If the minor premise is omitted it is known as the enthymeme of the *second order.*

If the conclusion is omitted it is known as the enthymeme of the *third order.*

Enthymeme of the first order :

Example: Rama is mortal because Rama is a man.

Enthymeme of the second order :

Example : Rama is mortal because all men are mortal.

Enthymeme of the third order :

Example : (This form is used in rhetoric and in law courts.)
All men are mortal beings and all ministers are men.

Section 8. Abreviated arguments

A. Epicheirema

Epicheirema is a type of highly condensed reasoning. It is an abridged reasoning. It is of two kinds.

If it uses an enthymeme in the place of one of the premises, it is known as the *single epicheirema.*

Example : All kings are mortal because they are men.
George is a king.
Therefore George is mortal.

If the epicheirema uses two enthymemes in the place of the two premises, it is known as the *double* or *complex epicheirema.*

All the minorities are entitled to freedom because they are Indians.

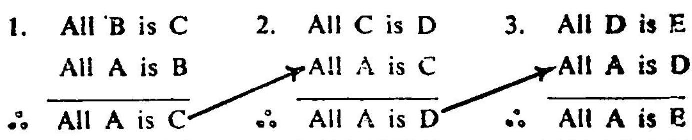
The Harijans are a minority; because they are small section.
∴ The Harijans are entitled to freedom.

B. The Poly Syllogism

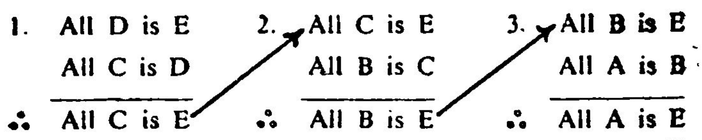
Two or more syllogisms may be connected together so that the conclusion of each stands as a premise, major or minor, of the next syllogism. Such a chain of reasoning is called a 'poly syllogism'. It takes two forms (a) *progressive or synthetic* (b) and *regressive or analytic.*

In the progressive type of poly syllogism we proceed from the premises to the conclusion.

Symbolic Example I



Symbolic Example II



In the regressive type of poly syllogism we proceed from the conclusion to the permises.

Symbolic Example:

1. All A is E because All D is E and All A is D.
2. All A is D because All C is D and All A is C.
3. All A is C because All B is C and All A is B.

C. *Pro and Episyllogisms*

Symbolic Example :

1.		2.		3.	
	All D is E		All C is E		All B is E
	All E is D		All B is C		All A is B
∴	All C is E	∴	All B is E	∴	All A is E

The syllogism whose conclusion becomes a premise of the next is called *pro syllogism* and the syllogism which has a previous conclusion for one of its premises is called the 'epi syllogism.'

In the example, given above, the first syllogism is a pro syllogism in relation to the second. The second is a pro syllogism in relation to the third.

The third syllogism in an epi-syllogism in relation to the first. The second syllogism is an epi-syllogism in relation to the first and pro-syllogism to the third. Thus the terms 'pro' and 'epi syllogism' are relative.

D. *Sorites*

Sorites is a chain of reasoning involving three or more premises. In it all the conclusions except the last are omitted. It is a reasoning which links syllogism on to syllogism. It is a poly syllogism with the intermediate conclusions suppressed. It is of two kinds.

1. Aristotelian sorites. (progressive sorites)
2. Goclenian sorites. (regressive sorites).

If the conclusion of a syllogism becomes a premise in an epi-syllogism the chain is progressive. If it takes place in the contrary direction it is regressive.

Aristotelian Sorites (Progressive)

All A is B

All B is C

All C is D

All D is E

∴ All D is E

This chain of reasoning may be split up into three separate syllogisms of the I figure as follows.

1. All B is C	2. All C is D	3. All D is E
All A is B	All A is C	All A is D
∴ All A is C	∴ All A is D	∴ All A is E

Rules

Rule 1. Only one premise may be particular and that the first.

Proof : Let us assume that the first premise is particular.
The syllogism will be as follows

A – All B is C

I – Some A is B

∴ I – Some A is C

Here no fallacy arises—The mood is Darii in Figure I.

Let us assume that the last premise is particular. The last syllogism will be as follows:

I Some D is E

A All A is D

∴ A All A is E

Here the fallacy of undistributed middle arises. Hence only one premise may be particular and that the first.

Rule 2. Only one premise may be negative and that the last.

Proof : Let us assume that the last premise is negative.

The syllogism will be as follows:

	E	No D is E
	A	All A is D
∴	A	No A is E

Here no fallacy arises. The mood is celarent in Figure I.

Let us assume the first premise to be negative. The syllogism will be as follows:

	A	All B is C
	E	No A is B
∴	E	No A is C

Here the fallacy of illicit major arises. Hence only one premise may be negative and that the last.

Goclenian Sorites (Regressive)

All D is E
All C is D
All B is C
All A is B
∴ All A is E

The chain of reasoning may be split up into three separate syllogisms of the I figure as follows:

1 All D is E	2. All C is E	3. All B is E
All C is D	All B is C	All A is B
∴ All C is E	∴ All B is E	∴ All Ais E

Rules

Rule 1. Only one premise may be particular and that the last.

Proof : Let us assume that the last premise is particular. The syllogism will be as follows :

	A – All	B is E
	I – Some	A is B
∴	I – Some	A is E

Here no fallacy arises. The mood is Darii in Figure I.

Let us assume that the first premise is particular. The first syllogism is as follows :

	I – Some	D is E
	A – All	C is D
∴	I – Some	C is E

Here the fallacy of undistributed middle arises. Hence only one premise may be particular and that the last.

Rule 2. Only one premise may be negative and that the first.

Proof : Let us assume that the first premise is negative. The first syllogism is as follows :

	E – No	D is E
	A – All	C is D
∴	E – No	C is E

Here no fallacy arises. The mood is 'celarent' in figure I.

Let us assume that the last premise is negative. The last syllogism will be as follows:

	A – All	B is E
	E – No	A is B
∴	E – No	A is E

Here the fallacy of Illicit major arises. Hence only one premise may be negative and that the first.

A comparison of the two types of sorites

Aristotelian	*Goclenian*
All A is B All B is C All C is D All D is E ∴ All A is E	All D is E All C is D All B is C All A is B ∴ All A is E
1. All B is C All A is B ∴ All A is C	1. All D is E All C is D ∴ All C is E
2. All C is D All A is C ∴ All A is D	2. All C is E All B is C ∴ All B is E
3. All D is E All A is D ∴ All A is E	3. All B is E All A is B ∴ All A is E

1. The subject of the conclusion is the subject of the first premise.

2. The predicate of the conclusion is the predicate of the last premise.

3. The predicate of each premise is the subject of the next.

4. In separating the syllogisms the first premise is used as the minor premise and the other premises are used as the major premises.

5. The conclusion of each pro syllogism is used as the minor premise in the epi syllogism.

6. Only one premise may be particular and that the first.

7. Only one premise may be negative and that the last.

1. The subject of the conclusion is the subject of the last premise.

2. The predicate of the conclusion is the predicate of the first premise.

3. The subject of the each premise is the predicate of the next.

4. In separating the syllogisms the first premise is used as the major premise and the other premises are used are the minor premises.

5. The conclusion of each pro syllogism is used as the major premise in the epi syllogism.

6. Only one premise may be particular and that the last.

7. Only one premise may be negative and that the first.

Exercises

First Type

I. Identify and examine the following arguments :

Note :

A. First restate the argument in the proper form.

(a) Pick out the conclusion, leaving space for the premises, write the conclusion first; put it in the strict logical form and mark the minor term (S) and the major term (P) by symbols.

How to pick out the conclusion ? We have to pick out the conclusion only from the entire meaning of the argument. However, the following hints may be useful. Sentences beginning with such words or phrases as 'hence' 'therefore' 'consequently' 'as a result of', 'it follows that', 'so' 'then'. 'I conclude', etc will be the conclusion. Sentences which precede the words, like 'for', 'as', 'because', 'since' will be the conclusion.

(b) From the terms in the conclusion we can easily find out the premise; write the major premise first (on the top) and the minor premise next. Put them in the strict logical form. Underline the terms in the premises and mark them by symbols as M, S or P as the case may be. Indicate distribution by ✓ and undistribution by x.

(c) Supply the missing members of the enthymemes, if any.

B. Examine the arguments :

(a) Apply the rules of the categorical syllogism one by one.

(b) Find out which rule is violated.

(c) If any rule is violated state and explain the fallacy.

(d) If no rule is violated state that the argument is valid, and state also the figure and mood of the syllogism.

C. Other instructions :

(a) Differences in grammatical number does not matter. Ignore minor changes of words.

(b) Extra words must be omitted in the logical form.

(c) Exclusive propositions should be reduced to A form.

(d) Write four sentences about each syllogism starting with these words (This.........Here.........According to......... Since ....)

Example :

1. All those who went to jail at the call of the country are patriots. How can you claim to be a patriot? You never went to jail.

Answer :

Restatement :

A All | persons who went to jail at the call of the country (M) | are | patriots (P)

E. You (S) | are not | one who went to jail at the ca' of the country (M)

∴ E. You (S) | are not | a patriot (P).

√ M a P ✗

√ S e M √

√ S e P √

This categorical syllogism commits *the fallacy of illicit major*. Here the major term is distributed in the conclusion without being distributed in the major premise. According to the rule, if a term is not distributed in its premise, it should not be distributed in the conclusion. Since the argument violates the rule it is invalid.

2. Pericles ruled Athens; Pericles' wife ruled Pericles. So Pericles' wife ruled Athens.

3. No cooked rice is hot, for no cooked rice is snow and no snow is hot.

4. Those who have no occupation are unhappy. Rich men have no occupation. Hence they are unhappy.

5. Death is happiness, for it is the end of life and the end of life is happiness.

6. Only women are mothers; men are not women, hence men are not mothers.

7. Some Germans are Jews and all Germans are clever. Therefore all Jews are clever

8. Being a car salesman you are probably a liar

9. No Scotsman is able to see the force of a joke. I conclude that you are a Scotsman.

10. Every human being has a right to vote. And all that I can say is that he has a right to vote.

11. All who are not guilty are innocent and Rama is not guilty.

12. Some great lawyers are *not good speakers*. Look at Ramanathan.

13. No great thing is easy. Truth is not easy for it is a great thing.

14. Spiders are not insects for all insects have six legs.

15. Any one who questions facts is unreasonable. A lawyer questions facts. Therefore, he is unreasonable.

16. This argument is an enthymeme because one of its premises is missing.

17. We are rich and we are members of the Rotaract Club. Therefore all the members of the Rotaract Club are rich.

18. This man must be deaf, because he talks aloud.

19. A spiritual substance is immortal. The human soul is, therefore, immortal for we know that it is a spiritual substance.

20. Lemons are not oranges and so they are not sweet.

21. Some wealthy men are not happy and I know that some virtuous men are happy. Hence some wealthy men are not virtuous.

22. No sensational newspapers is worth reading. Some newspapers are sensational.

23. Some philosophers are statesmen. Look at Dr. S. Radhakrishnan.

24. All cows are animals and no horses are cows. So no horses are animals.

25. Good men deserve reward and so our principal deserves one.

26. A few Central Party men are dishonest and hence they should be voted out of office.

27. He must be a wise man because he is always silent.

28. Gold is not a compound substance for it is a metal and none of the metals is a compound.

29. Death is an act of God. Therefore, it must be respected.

30. He who receives stolen property should be punished. So you should be punished.

31. Whatever causes strike should be abolished. Therefore, all college unions should be abolished.

32. What is not material is not mortal. The human soul is not material. Therefore, it is not mortal.

33. Socrates must have been a happy man for all wise men are so.

34. All people who snore must be isolated. Hence my brother must be isolated.

35. Every voter is a graduate and all graduates are scholars. Therefore, all scholars are voters.

36. All big boats in the little lake are little boats in the big lake. This is a little boat in a big lake. So this must be a big boat in a little lake.

37. This man shares his money with the poor. But no thief ever does this. So this man is not a thief.

38. Milk is white; chalk is white. There milk is chalk.

39. All lovers of sugar are sweet. All flies are lovers of sugar. Thus all flies are sweet.

40. The train is coming for the signal is down.

41. Raman is a law-abiding person for he pays his taxes regularly.

42. Everysincere man acknowledges merit in a rival.Every learned man does not do so. So every learned man is not sincere.

43. God created man; man created sin; so God created sin.

44. He must be a South Indian for he is fond of 'idlis.'

45. Every good law should be obeyed. The law of gravitation is a good law. Therefore, it should be obeyed. (Ambiguous Middle)

46. It hoots; therefore it must be an owl.

47. You must be a woman for you have no beard.

48. Birds have wings; bats are not birds; so bats have no wings.

49. No Muslims are idol worshippers; no Hindus are Muslims. The conclusion is obvious.

50. No one can believe a philospher because philosophers are always contradicting each other.

51. Only round things are shillings. The one rupee coin is round. So it is a shilling.

52. He blushes; therefore he is guilty.

53. No brutes are dependable because all rational agents are dependable.

54. The moon goes round the earth. The earth goes round the sun. Therefore, the moon goes round the sun.

55. He thinks too much. Such men are dangerous. Therefore, he must be dangerous.

56. Everyone who is sane can do Logic. None of your sons can do Logic.

57. Hoarding paddy produces misery. Hoarding paddy is gambling. Therefore, all gambling produces misery.

58. Whoever believes this is a fool you are no fool; therefore you won't believe in this.

59. No bachelor has a wife. This man has no wife. Therefore he must be a bachelor.

60. No lie is praiseworthy but some praise is a lie.

61. All catholics are christians. How can he be a christian when he is not a catholic?

62. Nuisance is punishable by law. To keep a dog is nuisance, Hence, to keep a dog is punishable by law.

63. He must be a Hindus for only Hindus wear caste marks.

64. Bats eat small insects. Bat is a short word. Hence, some short words eat small insects.

65. You are a liar. Therefore, you are a coward.

66. Every soldier serves his country. Women are not soldiers. Therefore, women do not serve their country.

67. Whatever is 360 degrees is hot; all circles are 360 degrees. Therefore, all circles are hot.

68. Everything that offends God must be hated. Every lie offends God. Therefore, every lie must be hated.

69. All mathematicians are good-tempered. No poets are mathematicians.

70. Everything that runs us away from God is evil. Some joys turn us away from God. Therefore, every joy is evil.

71. A good leader has the confidence of his followers. How can you say that he is a good leader ?

72. Every circle is round and it is a figure. So all figures are round.

73. Every fool is annoying. Some chatter-box is not annoying. Therefore, some chatter-box is not a fool.

74. A perfect being exists necessarily. God is a perfect being. Therefore, God exists necessarily.

75. All good citizens are ready to defend their country and they vote regularly at the elections. Therefore, all who vote regularly at the elections are ready to defend their country.

76. What is useless on a journey should be left behind; umbrellas are useful on a journey.

77. Some holidays are rainy. A few rainy days are tiresome.

78. No philosophers are gamblers because they are not conceited persons and a few conceited persons are gamblers.

79. You are not I. I am a man. Therefore you are not a man.

80. All books are man's creations and they are all subject to error. Therefore all man's creations are subject to error.

81. As the learning of logical formula does not give pleasure, it clearly has no value.

82. Ice is water; water is liquid. Therefore, ice is liquid.

83. He who has money can enjoy life. Your bank balance is nil. How can you enjoy life ?

84. Idiots cannot be men for man is a rational being.

85. The study of philosophy is useless for it has no business application.

86. A is a friend of B. B is a friend of C. Therefore A is a friend of C.

87. Ten is one number. Six and four is ten. Six and four are, therefore, one number.

88. He must be a Hindu. All Hindus believe in karma.

89. This man must be a great soul for he is persecuted.

90. No unmarried woman can be divorced. Mabel being unmarried cannot be divorced.

91. He must be a communist for he is vehemently condemning the gross inequalities of wealth in our society.

92. We are dependent on our motor cars and our motor cars are dependent on our chauffeur. So we are dependent on our chauffeur.

93. No honest men are advertisers because all advertisers are liars by profession.

94. Sankara, Ramanuja and Madhwa are eminent philosophers and they are religious reformers. Therefore, some religious reformers are eminent philosophers.

95. He has been a politician for years and is therefore not to be trusted.

96. No ghosts are real objects for all ghosts are illusions and no real objects are illusions

97. All rational beings are to be treated with respect in as much as they are made in the image of God. All Harijans are rational beings. Therefore, all Harijans should be treated with respect.

98. What is good is desirable; what is desirable is to be sought for, what is to be sought for is praiseworthy; therefore, all that is good is praiseworthy.

99. All thieves are dishonest; all dishonest persons are immoral; some immoral persons are not punished; therefore, some thieves are not punished.

Second Type

1. Explain why the following are invalid:

   O A A; A E I; A A E; I A A; I E O; I O O : OAE

2. Prove that:

   (a) no valid conclusion can be drawn from a particular major and a negative minor premise.

   (b) from two particular premises no valid conclusion can be drawn.

   (c) in a valid syllogism if the minor premise is negative, the major premise must be universal.

   (d) whenever the middle term is subject in the major premise, the minor premise must be affirmative.

   (e) whenever the minor term is predicate of an affirmative proposition, the conclusion must be particular.

   (f) in a valid syllogism, if the major premise is particular, the minor premise must be affirmative.

   (g) if the middle term is distributed in both premises, the conclusion cannot be universal.

   (h) when M is predicate in both the premises, O cannot be the major premise.

(i) when M is subject in both the premises, O cannot be the minor premise.

(j) when M is the predicate in both the premises the major premise must be universal.

3. Why is E I O always valid while I E O is never valid?

4. Determine the syllogism which has O for its major premise.

5. If P is predicate in the major premise what do we know about the minor premise?

6. Determine by general reasoning the figure and mood of the syllogism in which:

   (a) only one term is distributed and that once.

   (b) only one term is distributed and that twice.

   (c) only two terms are distributed each once.

   (d) only two terms are distributed each twice.

   (e) all the three terms are distributed.

7. In how many ways can 'No S i P' be proved syllogistically? Prove your answer from the general rules of the syllogism.

8. What can you say of a valid syllogism in which the middle and minor terms are distributed?

9. Determine the figure and mood of the syllogism in which:

   (a) the minor premise is an O proposition.

   (b) the major premise is an I proposition.

   (c) the major premise is an O proposition.

10. Prove from the general rules that:

    (a) O cannot be the major premise in the II figure.

    (b) O cannot be the minor premise in the III figure.

    (c) O cannot be a premise in the I figure.

    (d) O cannot be a premise in the IV figure.

(e) in the II figure the conclusion cannot be affirmative.

(f) in the III figure the conclusion cannot be universal.

(g) in the IV figure the conclusion cannot be A.

Questions

1. Explain the structure of a syllogism. What is the function of the middle term ? Why should it be distributed at least once ?

2. Given an original example of each kind of syllogisms and explain the structure of each.

3. Give examples to illustrate the difference between an enthymeme and immediate inference.

4. Define major and minor terms, major and minor premises. State the general rules of the categorical syllogism.

5. Explain the significance of the doctrine of distribution of terms in the categorical syllogism.

6. Explain why every syllogism should have three and only three terms. Illustrate the fallacy which arises from the violation of the rule.

7. Explain why the middle term should be distributed at least once. Name and illustrate the fallacy by means of diagrams.

8. State and explain why no term may be distributed in the conclusion which has not been distributed in its premise. Name and illustrate the fallacies by means of diagrams.

9. Explain with the help of diagrams, why no valid conclusion can be drawn from two negative premises.

10. Explain and illustrate the following :

    (a) Fallacy of four terms.

    (b) Fallacy of ambiguous middle.

    (c) Fallacy of undistributed middle.

    (d) Fallacy of illicit major.

(e) Fallacy of illicit minor.

(f) Figure of the syllogism.

(g) Enthymeme.

(h) Mood of the syllogism.

11. State the importance and the functions of the middle term in syllogism. Explain with examples.

12. "There is no foreigner among the wounded so no English man is wounded".

Supply a premise that will make this reasoning valid. Can you supply a permise that will make it. (i) guilty of illicit minor (ii) guilty of illicit major?

13. State and prove the special rules of the I figure. Derive its valid moods.

14. State and prove the special rules of the IV figure. Derive its valid moods.

15. What is an epicheirema? Give examples.

16. What is sorites? Distinguish the Aristotelian from the Goclenian sorites.

17. Write short notes on:

(a) enthymeme.

(b) poly syllogism.

(c) pro syllogism.

(d) epi syllogism.